THE GEOGRAPHICAL JOURNAL

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Monday October 30 *at* 5.30 *p.m.*

CARRIBEAN JOURNEY. *Kodachrome film with commentary by Mrs. Helweg-Larsen*

Monday November 13 *at* 5.0 *p.m.*

HUNTINGTON AND TOYNBEE: THE GEOGRAPHY OF ENVIRONMENT. *By Dr. O. H. K. Spate*

Thursday November 16 *at* 5.30 *p.m.*

FILM MEETING FOR TEACHERS OF GEOGRAPHY. *Three films introduced by Miss M. C. Simpson and Mr. G. J. Cons*

Friday November 17 *at* 5.0 *p.m.*

SURFACE NAVIGATION IN HIGH LATITUDES. *By Lieut.-Commander J. D. Moore, R.N. and Commander A. V. Thomas, R.N.*
A Meeting of the Institute of Navigation

Monday November 20 *at* 8.15 *p.m.*

Subject and Speaker to be announced later

Monday December 4 *at* 5.0 p.m.

SOIL EROSION IN NIGERIA. *By A. T. Grove*

Monday December 11 *at* 5.30 *p.m.*

WESTERN HIGHLANDS. *A film with commentary by Mr. F. R. Newens*

Light refreshments for Fellows and their guests will be served in the New Map Room after the Evening Meetings. Fellows are reminded that, unless special application is made, only one guest may be brought to Evening Meetings.

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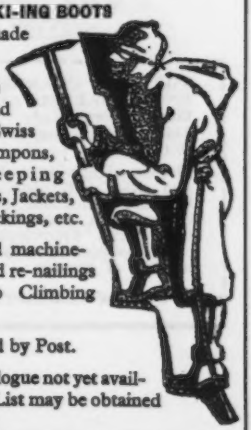

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The
GEOGRAPHICAL JOURNAL

Vol CXVI Nos 1—3 *July—September 1950*

ADDRESS AT THE ANNUAL GENERAL MEETING, 1950

SIR HARRY LINDSAY, K.C.I.E., C.B.E.

SOME OF YOU may remember that in last year's address I gave an account of the current activities of the Society under three main heads, the international, the national and the domestic. This year I propose to vary the theme. I wish to discuss with you first the scope or pattern of Geography in general; and then to consider how our current activities—that is, the work of the Society during the past year—fit into that pattern. So this address will fall into two parts. I will examine very briefly the general scope of Geography and, descending from the general to the particular, review the year's work of the Society in the light of the pattern which may emerge.

We begin then with Exploration. We cannot avoid it. We would not if we could. Exploration is the essence of Geography—it combines romance with adventure and it satisfies a primitive and deep human craving to know more and yet more about the globe on which we dwell. The great explorers of the past are an inspiration to us all. I will spare you long lists of names and dates. The names you will find written in golden letters round this Hall; and of course you will easily be able to fill in the dates, mentally, for yourselves.

But Exploration by itself is not enough. There follows Discovery, and with Discovery the systematization of the results. The instrument and the map are not only the products of early exploration; they are also the means by which exploration deepens and widens its range. The individual explorer becomes a team, comprising scientists of many different interests. Exploration thus develops by systematization into Survey, and thereby widens still further the scope of scientific research. It is not for nothing that the great Dome of Discovery in the South Bank Site of the Festival of Britain will combine the romance of the earliest explorers and merchant adventurers with the discoveries of modern science and the records of British surveys. I do not need to describe the surveys in any detail. They are a comparatively modern development, as Governmental institutions supplemented by private enterprise—in Britain the Ordnance Survey, the Directorate of Military Survey, the Hydrographic Department of the Admiralty and the Directorate of Colonial Surveys are outstanding examples. An air survey of Canada has been

in progress during the past twenty-eight years, in which between thirty-five and forty aircraft of the R.C.A.F. are now taking part.

Nor can we rest here, with Survey, for science is not merely a growing corpus of knowledge acquired by experts for experts. It is a national inheritance and must be built into the national character. Geography becomes an essential factor in education. Indeed, in its reconciliation of science with art, geography bids fair to take a unique place as a *sine qua non* of British education.

And can we stop at education? Not unless our education stops with adolescence, which God forbid. Education is a means, not an end. It leads us on, step by step, from family, school and social life to the full responsibilities of Citizenship—through National to Commonwealth and eventually World Citizenship. And at this point, at the conception of World Citizenship we may, I think, take our final stand.

So you see our general survey has led us from the romance of exploration and discovery, through systematic science (the instrument and the map) to the survey. Thence it broadens into education, juvenile and adult, and finally emerges into the greatest adventure of all, the privileges and responsibilities of citizenship. We begin with romance and we end with adventure, and in the intervening stages of our journey we learn the reconciliation of science with art in that supreme philosophy which is education.

Now I turn to the current activities of the Society during the past year; and I think that you will be able to see for yourselves how naturally and simply these activities fit into the pattern of geography which I have described. We begin, naturally, with exploration.

I mentioned last year the preliminary plans for a joint Norwegian-British-Swedish expedition to the Norwegian Antarctic territory of Queen Maud Land. From the beginning our Society has been closely concerned with this expedition. Not only did we give it financial support, mainly with funds from the Geographical Magazine Trust; we were also strongly represented, with the Scott Polar Research Institute, on the Joint Committee which controlled the British side of the partnership, under the Chairmanship of Mr. Wordie our Foreign Secretary, and with the help of Mr. Kirwan, our Director and Secretary who has acted throughout as Chief Executive Officer.

The *Norsel*, the 700-ton Norwegian expedition ship, left England towards the end of October last. It carried on board not only a British contingent of four scientists—including one Australian and one Canadian—but also an R.A.F. flight of five under the command of Squadron-Leader Walford, with two Auster aircraft. It also carried two official observers representing two Commonwealth Governments, Mr. Philip Law, of Australia, leader elect of the forthcoming Australian National Antarctic Expedition, and Mr. J. A. King, of the Union of South Africa, who is chief of the synoptic section of the South African Government's weather bureau. As many of you will have seen from the dispatches in the *Times*, the expedition, under its Norwegian leader Captain John Giaever, made a successful landing despite most difficult ice-conditions; a landing by the first International Polar expedition on a stretch of coast never before explored, though parts of it had been photographed from the air before the war. To the success of this landing the air reconnaissances of the R.A.F. were of course a vital contribution, reinforcing what can

only be described as the genius for ice navigation shown by the master of the *Norsel*, Captain Jakobsen. Three large wooden huts have been set up at the winter base, called Maudheim, and the expedition will remain in the Antarctic to carry out scientific work until 1952. The almost luxurious equipment of the camp—in striking contrast to that of earlier Polar expeditions—is best described in the following message from Gordon Robin, of Melbourne, senior member of the British party: "Maudheim has now become a bastion rather than an outpost of civilization, with electrical power station, hydrogen gas-works, weasel taxi service and chef." I should perhaps explain that "weasels" are amphibious and tracked snow vehicles of a war-time type and that they proved of great value in the landing operations.

At this point I must remind you that we have with us to-day Professor Sverdrup, for whom His Majesty the King has approved the award of the Patron's Medal of the Society for 1950. Professor Sverdrup, as Director of the Norwegian Polar Institute, has shouldered the main burden of executive responsibility for the Queen Maud Land Expedition. He will shortly join, in the distinguished list of our Gold Medallists, his Swedish colleague, Professor Hans Ahlmann, chief Swedish organizer of this expedition.

The international expedition to Queen Maud Land is far and away the largest and most important expedition with which this Society has been connected for many years. But this year, as in former years, we have also been concerned with a large number of smaller expeditions for geographical exploration in different parts of the world; expeditions to Iceland, central Nepal, the Karakoram region of the Himalayas, West Greenland, Jan Mayen Island, central Persia, Libya and southern Arabia. These, and others to Algeria and Finmark, we have helped to the best of our ability, either by direct financial support, the loan of instruments or in other ways. Altogether we received during the past twelve months twenty-one applications for grants in aid of such exploratory work. To those which passed the rigorous investigation of their plans conducted by the Research Committee, under the able chairmanship of Professor Steers of Cambridge, the Council voted a sum of over seven hundred pounds. It will be remembered that in 1949 the Geographical Magazine Trust made a contribution of £200 to this work, and we are hoping that they will contribute again. These may not sound large sums but they represent, as I think you will agree, a substantial contribution in these hard times. We hope, through the Appeal already sent to Fellows earlier in the year, to be able in due course to increase this sum. But I will refer to this matter again later.

The part which this Society and you its Fellows are playing in the support and organization of scientific exploration is in keeping with the high traditions which it has always been our pride to maintain. But exploration is only a means contributing to the broad object of our Society, namely, the advancement of geographical science. Here, in the international but academic field, we have been increasingly active. A member of our Council, Brigadier Bagnold, F.R.S., is chairman of the British National Committee for Geography, under the aegis of the Royal Society. Our Society has moreover become the collecting centre for academic and scientific news on geographical matters of all kinds within this country, for publication in the new bulletin of the International

Geographical Union. Later this year, the Executive Committee of the Union itself, drawn from many countries, will be meeting in London to discuss, among other matters, plans for the next International Congress of Geography, to be held in Washington two years hence.

The same balance and coordination between scientific exploration and geographical research is shown in the publications of the Society and in the work of the Research and Expeditions Committee. For example, a new edition of our well-known 'Hints to Travellers' is now being planned and this will contain, as in the present volumes, advice on survey and on the technique of travel. Research will be treated in a separate volume which will advise the non-specialist traveller on the many ways in which he can help the specialist at home by observations and by the procurement of specimens. The present edition has a very wide sale and was found of great use during the war. The new edition will, we hope, contain much new material which the war itself has made available, on questions such as diet and equipment of all kinds, for tropical as well as polar climates. The Research Committee, with the Publications Committee, will be responsible to Council for the publication of the new volumes, which will be expanded from two to three.

Another project of the Research Committee is the production of a series of descriptive pamphlets to accompany selected sheets of the 1-inch Ordnance Survey map. This will be the fulfilment of a suggestion first made many years ago by the late Dr. Hugh Robert Mill, and now revived and advanced by Professor S. W. Wooldridge. These pamphlets will be sold with the map sheets and will enable the user not only to read but also to understand the geographical significance of the British countryside in all its aspects, both the physical features in themselves and also their bearing upon history and social and economic relationships. I am happy to say that official approval for the production of a number of such pamphlets by the Ordnance Survey, working in cooperation with the Society, has already been received.

Such "sheet memoirs," as they have been termed, have of course great educational value; and education is another important field of the Society's activity. For many years now, we have been closely in touch with University geography. Indeed, we helped to found and maintain Chairs of Geography at the Universities of both Oxford and Cambridge. More recently, in cooperation with the Geographical Association, we have extended our activities into the field of school geography in various ways. Our Education Committee, under the experienced chairmanship of Dr. Laborde, has this year not only prepared a most useful pamphlet for educational authorities and appointments boards of all kinds entitled "Careers for Geographers" but is also considering another report which will embrace the relationship of geography to other subjects, such as social studies, in the school curriculum. This Committee is concentrating on the improvement of the status of geography as a teaching subject for it is one which, both in school and university, is attracting a steadily growing number of students.

So far, in this record of the year's activities, you will have noticed how closely exploration and discovery fit in with scientific research, and how the record passes to education in all its aspects, and to that geographical know-

ledge, that grasp of men and affairs which is essential to citizenship. In all these fields the true geographical basis is the map, and I will turn now to our Library and Map Room.

These have during the year kept up a high level of activity. Our Map Room, open to the general public and subsidized by a Government grant which remains unchanged at £2000, has received about 20,000 sheets of maps during the year. Of these about half have been catalogued and incorporated in the collection, and 2000 maps already in the collection have been re-catalogued. During the year about 5500 volumes were issued on loan from the Library, and the average number of borrowers per week was sixty, the highest since 1936; in addition, increasing numbers of students have consulted volumes in the Library. As opportunity offered, older books have been removed to the new shelving in the Gallery, and the periodical store has been cleared and re-arranged.

As part of our educational effort the annual Exhibition has now come to stay, though from time to time high costs may force us to reduce its scale. This year we have staged an exhibition on the exploration of modern Africa. Only one object came from outside the Society's collections; and that, from the Imperial Institute. The rest, maps, charts and relics of all kinds, illustrated the phenomenally rapid exploration of Africa during the nineteenth century and, in their display, linked the great pioneering expeditions of Livingstone, Stanley and others—with all of which your Society was in one way or another directly concerned—with the more precise and specialized expeditions of to-day.

Another development in the educational field is our new programme of geographical films for teachers. At these meetings, the first of which was held with the National Committee for Visual Aids in Teaching, producers and teachers can freely discuss their mutual needs and problems.

Additional services of this kind, public services rendered through our Map Room as well as through our Library (the latter properly restricted to Fellows), financial aid to expeditions and research, the high cost of our *Journal* which, like most periodicals of societies such as ours, cannot be self-supporting; all these place a heavy burden on a private society like ours, relying as it does almost entirely on the subscriptions of its members for its support.

I must now make a brief reference to the Society's finances. During 1949, following the deficit of £1373 on our Income and Expenditure account for 1948, we have practised a rigorous economy. This economy, though it has to some extent restricted the scope of our activities, has resulted in a slight balance of income over expenditure amounting to £465. On this, congratulations are due to our Finance Committee, under the efficient chairmanship of Mr. Leonard Brooks. At the same time, we recently circulated to Fellows through the *Geographical Journal* an appeal for legacies and donations to our General Fund, for expenditure on scientific objects such as exploration and research. This Appeal has already produced one or two substantial results. Our Fellowship has, it is true, increased from 5918 to 6018; but the size of our Fellowship must always be controlled by the need for careful scrutiny of the candidates presented. An increased income from capital investment is therefore one of our most urgent needs.

In a year when costs of all kinds continued to rise, the generous bequest of the late Mrs. Hyde-Maberly, amounting we hope to as much as £40,000, was exceptionally welcome and has relieved us of some of our financial anxiety which caused us recently to consider whether we should not have to raise the subscriptions of Fellows, unchanged since 1908. This, together with such gifts as that from Mr. Vaughan Morgan of £100 and Mr. I. D. Margary of £100, will enable us to some extent to keep pace with heavy overhead costs, to improve the amenities of the building for the use of Fellows—here much still remains to be done—and to increase our contributions in aid of research and especially of exploration.

Difficult as these times are for private societies like ours, dedicated to the advancement of science, we have I think no reason to be dissatisfied with the progress and developments of the past year.

I cannot conclude this Address without reference to the sad loss of a number of distinguished Fellows; among them I can but recall those particularly active in their association with our Society. Lord Biddulph was a member of a family which had been connected with the Society from its foundation, and had himself rendered valuable service as Honorary Treasurer and Trustee. Dr. H. R. Mill, geographer, Polar historian, and meteorologist, had been Librarian of the Society, member of Council and Vice-president for many years, and a Victoria Medallist. A Gold Medallist and a geographer of world-wide reputation whom we have lost was Dr. Isaiah Bowman, formerly Director of the American Geographical Society and President of Johns Hopkins University. Mr. A. M. Champion, remembered for his work on the geology and geography of East Africa, received the Founder's Medal in 1939. Sir Henry McMahon, well known for his distinguished career in India and the Middle East, had been a member of your Council and a Vice-president. Dr. Edward Lynam, a member of Council at the time of his death, and Superintendent of the Map Room at the British Museum, was an authority on historical cartography. Frank Smythe was a first-class mountaineer with a great record in the Himalaya and elsewhere, whose books and photographs are widely known.

ENGLISH MAPS AND MAP-MAKERS OF THE SIXTEENTH CENTURY

EDWARD LYNAM

IT IS HARDLY a boast to say that the English have a natural talent for map-making. Certainly the Matthew Paris and Bodleian maps of England of 1250 and 1340 respectively and the Hereford map of the world of 1300 were each without rival of its kind and its time; and the English have moreover the distinction of being the first people to publish both a national atlas of their own, Saxton's atlas of 1579, and a national road atlas, Ogilby's "Britannia" of 1675. These however were the high lights, and it was not until the middle of the reign of Henry VIII that the harmless, necessary local map began to play a part in the life of the country. Local plans of lands and estates, drawn either as evidence for lawsuits or at the order of the new owners of the estates of the dissolved monasteries, seem to have been made in numbers after about 1520. Unfortunately very few have survived: one is a plan [1] of some lands near Walthamstow which were in dispute in 1527. I suggest the name bird's-eye plan for this kind of map because the area is represented as it would be seen by a bird flying over it and catching sight of each feature at an angle of about 70°. During most of the sixteenth century this method was practised for small areas and for towns, with many improvements as time passed (Plate 3). It derived from the crowded pictorial landscapes and stately battlemented cities in the miniatures which adorned fifteenth-century manuscripts; but the necessity for accurate ground-plans, which did not exist in the miniatures, was recognized, and these were measured out as accurately as the knowledge and the instruments of the time permitted. But to mark in neatly, distinguishably and in proportion the features which had to be included, those in fact which were not flat like roads and streams, such as hedges, buildings, trees and hillocks, was not easy for the land-measurers of those days, whose drawing was like that of children, always in elevation. A plan of Chertsey Abbey and its lands in the Public Record Office, though a century earlier (1432), is a better example of this composite method. An inscription over each field gives its area, but the buildings might have been drawn to embellish a fifteenth-century romance. It should be remembered however that in 1527 "a corde v perches long sered in hote waxe or rosyn" was commonly used as a measuring chain, so that the area of fields often depended upon the weather.

A great deal has been written about the achievements of Henry VIII in making England a maritime power, his shipbuilding, his development of ports such as Hull, Dover and Portsmouth, his introduction of foreigners such as John Rotz as naval instructors. The manuscript views which he had drawn of many of the important harbours and estuaries of southern and eastern England are much less known. These, if we except the Bodleian map, are our earliest surviving official English maps, and as such many of them have been preserved in the British Museum, the Public Record Office and some of the

[1] B.M. Add. MS. 18783, *fol.* 81.

great private collections. They also represent the earliest attempts of Englishmen to chart their own coasts, for they were intended to be charts as well as views. One drawn about 1536 depicts the coast and hinterland between Exmouth and the headland of Tor and its little harbour, now Torquay (Plate 1). Distances have been foreshortened in depth, and lateral distances contracted in order to show mariners the features they would look for—for some the way to Exeter, then a port, for others the shelter of the Exe and Teign rivers, and for those remaining out at sea the prominent landmarks of Cockswood House, Powderham Castle and Lympstone. The land is tinted a pleasant green and brown, the sands are yellow and distances and good landing-places are described in writing as here: "Torre sands, a quarter of a mile long, and in all these sands good landing." These views, like those of the land, were bird's-eye plans. In order to get into the picture so much that was not visible from any one point at sea, there may have been three separate operations. Several sketches were drawn on land, all with relation to aligned focal points out at sea; diagrams were drawn from a ship anchored successively at these points, the draughtsmen using a Jacob's Staff, then a very popular mariners' instrument, as a protractor to measure his lateral and vertical angles; finally all the sketches and diagrams were combined to form the view. Sketching from the masthead must be a very old nautical practice; I have seen many silhouettes taken from the topmasthead in the eighteenth century. The angle of these is of course much lower than that of the bird's-eye plans.

These early views and charts were seldom signed by their official draughtsmen. But thirty years later, when Queen Elizabeth's surveyors and engineers, men with an official status, were continuing the same work, their charts were greatly superior. Indeed, I consider one of these, Richard Popinjay, who was employed at the ports of the south coast and in the Channel Islands from 1562–87, to be our most notable native map-maker before Saxton. Part of one of his manuscript official maps drawn in 1563, showing St. Helier, Jersey, is here reproduced (Plate 2). Several of the coastal features are novel—quays, anchorages, submarine rocks and, of especial note, a scale; while the land features, which now include roads, a rarity on maps, are represented from a higher angle than in the view of Tor and are therefore clearer and more in plan.

While the outline of England was thus being sketched piecemeal at home, the first modern map of the British Isles was published at Rome in 1546. It was the outcome of the efforts of a group of English Catholics, with whom George Lily, chaplain to Cardinal Pole and an exile at Rome, seems to have been in close contact. It cannot be regarded as purely English. We must give credit to Italian craftsmen and experts for the engraving in copper, for the dignified and handsome cartouches and perhaps, too, for the neat symbols for large cities, county towns and cathedral towns. The map itself however was compiled and drawn in its first form by Englishmen. For its time it is remarkably, refreshingly accurate. This inclines me to believe that it was prepared at home, not at Rome as has been generally believed on the strength of the inscription upon it, "Anglorum diligentia & studio." I suggest that it was compiled by a group of English patriots, inspired by the antiquarian and historical ardour of the Renaissance. Deciding to have it

engraved, they sent it to their friends at the centre of engraving, Rome, who arranged and supervised its publication. As to its sources, the influence of the Bodleian map of two centuries earlier and of a more recent map of England of about 1534 called "The Cottonian Map" are easily detected in it. Only a single copy of each of these has survived, but it seems probable that other copies, as well as copies of other maps now lost, were well known in 1546. Moreover, in the archives of the county sheriffs and the legal officers of administrative units all over England, there were records of thousands of boundaries—boundaries of counties, baronies, hundreds, manors, forests, liberties, going back to Domesday Book; and these must have been utilized for the preparation of more sketch maps of an elementary kind than is now generally realized. Two important scientific features hitherto not used by English map-makers are seen on this map—the use of a simple conical projection and the marking of latitude and longitude in the borders.

By 1555 the Flemings had begun to rival the Italians as engravers in copper, and it was Thomas Gemini, a Belgian, who introduced that art into England after 1550. His main work was illustrations to books, but when George Lily returned to England after the accession of Queen Mary, bringing with him the copper-plate of the Rome map of 1546, Gemini made some alterations in it, including the insertion of his own name and the date 1555, and printed copies of it in London. Yet so precarious is the life of a map that only one copy of that map is now known, and that is in the Bibliothèque Nationale at Paris. Gemini is more important as the friend, possibly the instructor, of our first great English craftsman in metals, Humphrey Cole. Cole, a north-country man who held a post in the Mint, maintained a workshop in London whence between 1555 and 1588 he and his assistants turned out a number of instruments—astrolabes, dials, gunner's compasses, theodolites and circumferentors—which are among the most accurate of their kind and testify to the natural talent of the English for mechanics. He was also a pioneer engraver in copper, and in 1572 engraved a map, the earliest known to have been engraved by an Englishman. Copied from a foreign map, it was made to illustrate a Bible of that year. The naturalistic composition of the cartouche, richly adorned with fantastic flowers, fruits, animals and pseudo-classical masques, is obviously imitated from Flemish maps, and provides instructive contrast to that of the "Lily" map, which was purely Italian.

The earliest plan, or rather bird's-eye plan, of a town known to have been engraved by an Englishman was of Cambridge, by Richard Lyne, who had been taught his craft by another Fleming, Frans Hogenberg (Plate 4). Lyne executed this plan in 1574 for Archbishop Parker, to illustrate Dr. John Caius's 'De Antiquitate Cantabrigiensis Academiae.' Its spacious lanes and rustic features would bring tears of envy to the eyes of an undergraduate living in the overcrowded Cambridge of these days. This picture cost Parker thirty shillings for the copper-plate, two shillings for the "cullers," which were put on by Lyne by hand, and twelve shillings to Lyne as his fee for "carving" or engraving the plates.

After this date more and more town plans were engraved. Though they were all bird's-eye plans, they were accurate on the ground, so that they combined a true representation of all the features—streets, alleys, crossings,

market-places, squares, churches, town pumps, etc., with very handsome, interesting and at the same time correct elevations of all the buildings. For us they are both more attractive and more instructive than ground-plans of the modern type would be. An early manuscript town plan of Bristol, surveyed in 1568, appears to show the magnetic variation, which was not given on normal English maps until some forty years later. Indeed, the text-books state that magnetic variation was first observed and recorded in England in 1581, when Thomas Hood and William Borough found it to be 11° 15′ E. at Limehouse. As very little was known about the secular variation, that figure was accepted in England for the next fifty years, until Edmund Gunter took fresh observations in 1622. But 'Pantometria,' by Leonard Digges, published in 1571, ten years before the date given above, mentions the same observation, and so far as I can see the variation marked here for Bristol in 1568 is the same. The author of this plan was William Smith, later a herald (Rouge Dragon Poursuivant), who has a place among map-makers, for in the 1580's he drew manuscript maps of Cheshire, Lancashire and Staffordshire, a fine and accurate plan of Chester, and wrote a manuscript 'Description of England.'

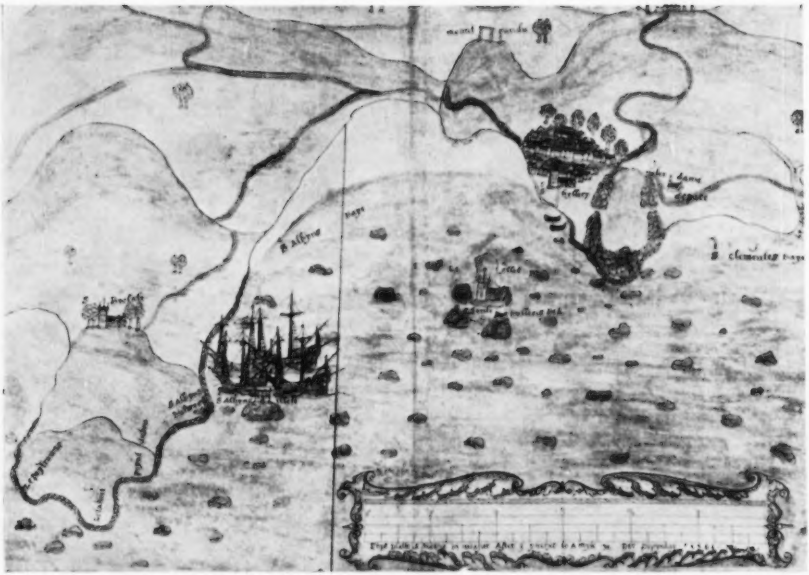
Surveyors' methods and instruments

Parallel with the spread of copper engraving on the Continent after 1500, a number of mathematicians and instrument makers, mainly German or Alsatian, such as Regiomontanus, Waldseemüller, Peurbach and Peter Apian, invented new and much more precise instruments for taking astronomical observations and for surveying. The great political and religious changes and the widespread increase of travel which resulted from the Renaissance and the Reformation brought many Englishmen into touch with these scientists. In 1533 Gemma Reiner (or Frisius), a professor at Louvain and tutor of the great cartographer Mercator, published a book, 'Libellus de discribendorum locorum ratione,' which simplified surveying greatly. William Cuningham, a Norwich doctor who had spent some years at Heidelberg and become enthusiastic for the new Continental methods, published a fascinating book, 'The Cosmographical Glasse,' which embodied contemporary ideas on cosmography, astronomy, geodesy, chorography and the construction of maps, with special reference to England. Using the church towers of Norwich, Swarston and Wymondham as his stations, for example, he observed the horizontal angles to each of the others, and as he knew by pacing or by the local reckoning the distance between any two, he could easily plot a triangle. Within this he could insert the topographical features, using a chain—or one of the current substitutes, such as a "wyer toe pole long"—for short distances. The instrument which he used for measuring horizontal angles was an adaptation of the back of the astrolabe, with inset compass, and was really Gemma Frisius' *planimetrum*. Turned sideways, it could be used to measure heights. It was in fact the forerunner of the circumferentor, the favourite instrument of surveyors from about 1580 to 1670.

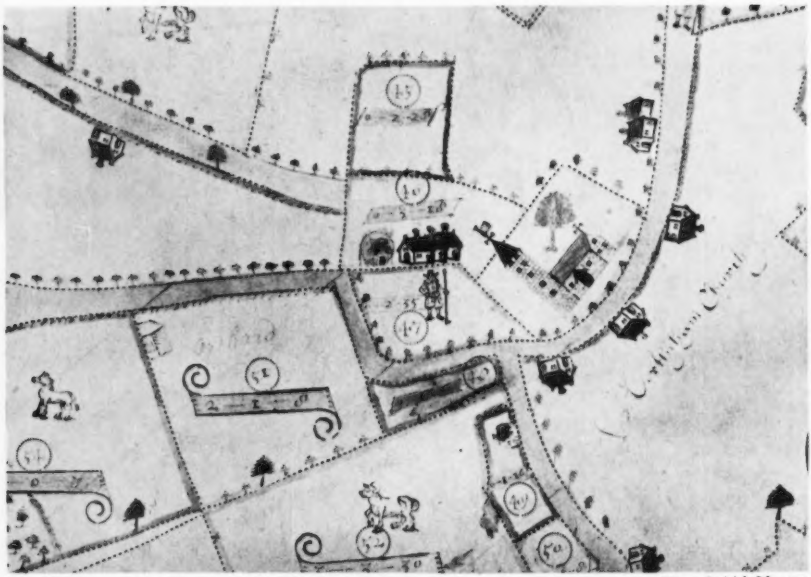
'Pantometria,' by Leonard Digges, published by his son Thomas in 1571, is a landmark in the history of English surveying and cartography. It is a masterly treatise on the use of nearly all the best instruments then known for taking observations, angles and measurements, such as the various adapta-

Phot. British Museum

1. Exeter and the coast between Tor Bay and Exmouth, c. 1536



2. St. Helier, Jersey. Drawn by Richard Popinjay, 1563



Phots. British Museum

3. "Certayne landes and Tenements lyeing in the p̃ish of Northiham . . . belonging unto Thankefull Frewen." An estate survey by Giles Burton, 1635

tions of the back of the astrolabe with sighted alidade and shadow scale, the sighted quadrant and the geometrical square. Among these is a "theodelite" invented by the Digges, father and son. It was based on the same principle as our modern theodolite in that it consisted of a graduated horizontal disc with a rotating sighted alidade, above which was fixed a vertical semicircle equipped with sights and a quadrate. A theodolite made by our matchless Humphrey Cole in 1586 had a semi-circle, quadrate and sighted index. From them it is clear how the angles of altitude were measured. But it must be remembered that in this, as in all contemporary instruments, the sights were open, large and non-telescopic, so that they covered too large an area vertically and laterally for observations to reach any high standard of accuracy. The telescope was the foundation of sound cartography, as it was of astronomy. The theodolite, an invention always credited to the English, was probably little manufactured or used in this country before about 1660. It had two rivals, both more convenient, the plane-table and the circumferentor. The former, which was probably introduced from France about 1555, differed only in minor details from our modern instruments and quickly became popular with the less expert estate surveyors. The circumferentor, which came into use about 1571, consisted of a rotating graduated disc with a compass inset, and outside it on another disc, a fixed sighted index, the whole mounted on the top of a staff by a ball and claw arrangement. For horizontal angles it was used much as is a modern prismatic compass. To take vertical angles the whole instrument was dropped through 90° on the ball and claw hinge. It was used for surveying largish areas, the plane-table for small.

The creation of a new landed gentry in England which followed upon the redistribution of the vast estates of the dissolved monasteries created a widespread demand for estate-surveyors and map-makers. Most of the manorial Terriers, Extents and Rentals were out of date and in any case not one in two hundred had ever been accompanied by a map. Everywhere there was confusion, concealment, doubt about boundaries. But at this period, *c.*1560, there was a great dearth of men capable of re-surveying, and more particularly of making reliable maps of the newly formed estates. The result was that for some years a great deal of very indifferent mapping was carried out all over the country by men who called themselves "Surveighors" but whose only qualifications for that title were a slight acquaintance with elementary mensuration and the possession of a plane-table. Their methods are humorously described by Edward Worsop in his book on surveying, 'Sundrie errours committed by land meaters,' 1582: "When the lands were parted betweene my Mystres and her three systers, there were there certain lawyers, valuers and country measurers, and for three or four days great controversie was among them and such a stir as I never sawe amongst wise men. Some wold have the land measured one way, some another. Some brought long poles, some lines that had a knot at the ende of every perch, some lines that were sodden in rosin and waxe to avoide stretching thereof in the water and shrinking in the drought." By 1590 however the demand for better maps, together with the publication of the 'Pantometria' and of some handbooks on surveying, had begun to attract educated men, including University men, into the profession. These, among whom William Hayward, Israel Amyce, Thomas Marshall and Ralph

Aggas were notable, soon learned to combine the duties of the old estate stewards or "surveyors" in interpreting manorial law and old manorial documents in Latin and Norman-French with those of estate map-makers, and in time they acquired for themselves a high professional status. In 1582 indeed, Worsop proposed to establish a Faculty of Surveyors, the members of which should have certified qualifications. It was from this class, the only trained surveyors in the country, that emerged our earliest makers of county maps, Christopher Saxton, John Norden, Philip Symonson. The year 1590 marks the beginning both of the production of really first-class manuscript estate maps in numbers and of the general adoption by their makers of the handsome style and the ornament of the engraved maps. The title cartouche of an estate map of 1591 by John Walker senior, of Essex, displays for instance the same naturalistic style and colours as an engraved map in Ortelius' atlas of the same year. The surveying instruments in use were the plane-table and the circumferentor.

All these developments in the science of surveying, in surveying instruments, in mathematical knowledge, as well as in social, economic and political conditions, produced many maps and plans of the regions, towns and harbours of England which have now disappeared. Contemporary references to them however are very numerous. We have for instance Laurence Nowell's manuscript maps of the British Isles and his famous letter in 1563 to Cecil proposing to make maps of the English counties and mentioning the bad ones already in existence; Mercator's statement that his map of the British Isles of 1564 was largely compiled from information supplied by an Englishman; and two mysterious allusions to maps in connection with Holinshed's 'Chronicles.' One is by Nicholas Reynolds, a map-maker employed by Reyner Wolfe the initiator of the 'Chronicles,' and later the engraver of Saxton's Hertfordshire. In 1573 Reynolds wrote of "our maps." The other is by William Harrison, who in his well-known contribution to the 'Chronicles' spoke of a lost set of maps of the English and Welsh bishoprics. We have, too, several official maps of the 1570's, such as those of the Scottish borderlands drawn by Rowland Johnson, the Queen's Surveyor at Berwick 1571–78. Humphrey Lhuyd's map of England and Wales, published in Ortelius' 'Theatrum' in 1573, had been completed some four years earlier.

Christopher Saxton: the first Atlas of England and Wales

Now it was, I suggest, in 1572 that Thomas Seckford, lawyer, courtier and patriot, commissioned Christopher Saxton to survey and map all the counties of England and Wales. Saxton is rightly the most famous of the English map-makers of the sixteenth century. His atlas of 1579 was not only the first national atlas produced by any country but a lovely and enduring expression of the spirit of Elizabethan England. As Sir George Fordham has shown, he could not have been more than twenty-eight years old in 1572; and it has long been a matter of wonder that this obscure young Yorkshireman could have produced, apparently with little training, such competent and finished work. A map recently discovered in a private collection in Ulster shows him however in a different light. This is a coloured chart, drawn on vellum, of Belfast Lough and its coasts from Belfast to the sea. It has no title,

but is endorsed "Baie of Cragfargus" and signed "Christopher Saxton after Michael Fitzwilliams 1569." Another manuscript copy of it, bearing neither title nor date, was formerly in Sir William Cecil's collection and is now in the Public Record Office (M.P.F. 77. S.P. 64/1. No. 10). It is not in Saxton's hand nor, so far as I can discover, in that of Fitzwilliams, who was Surveyor-General of Lands, Plantations and Mines in Ireland, 1552–73. The fact that Saxton was employed to copy a document of such political and military importance proves that already in 1569 he had won a reputation as a cartographer and that Seckford selected him for that reason. I understand that the owner of this map will present the original or a reproduction of it to the Public Record Office at Belfast.

It is unfortunate, and indeed extraordinary, that we do not possess a single reference by either Seckford or Saxton to their atlas of England, although for each of them it was the proudest achievement of their lives. Astonishingly little is known about Saxton personally or about his methods of work. But if he completed such a vast undertaking in less than seven years (1572–79) he must have plotted his maps, as far as possible, from successive heights all over the country, from "Towre, Castle, highe place or hill," as recommended in the Queen's open letter of 1576, keeping his assistants and guides busy down below in the collection of information about local place-names, distances and boundaries. This indeed is indicated by his representation of hills, which he shows in full elevation. He must have ascended some of the same eminences and church towers as were used by the surveyors of the Ordnance Survey 250 years later; but triangulation and the representation of hills in plan were arts unknown in his time. He most probably plotted his angles with the *planimetrum* or "geometricall instrument" used by Gemma Frisius and Cuningham, and sketched his maps piecemeal on a plane-table.

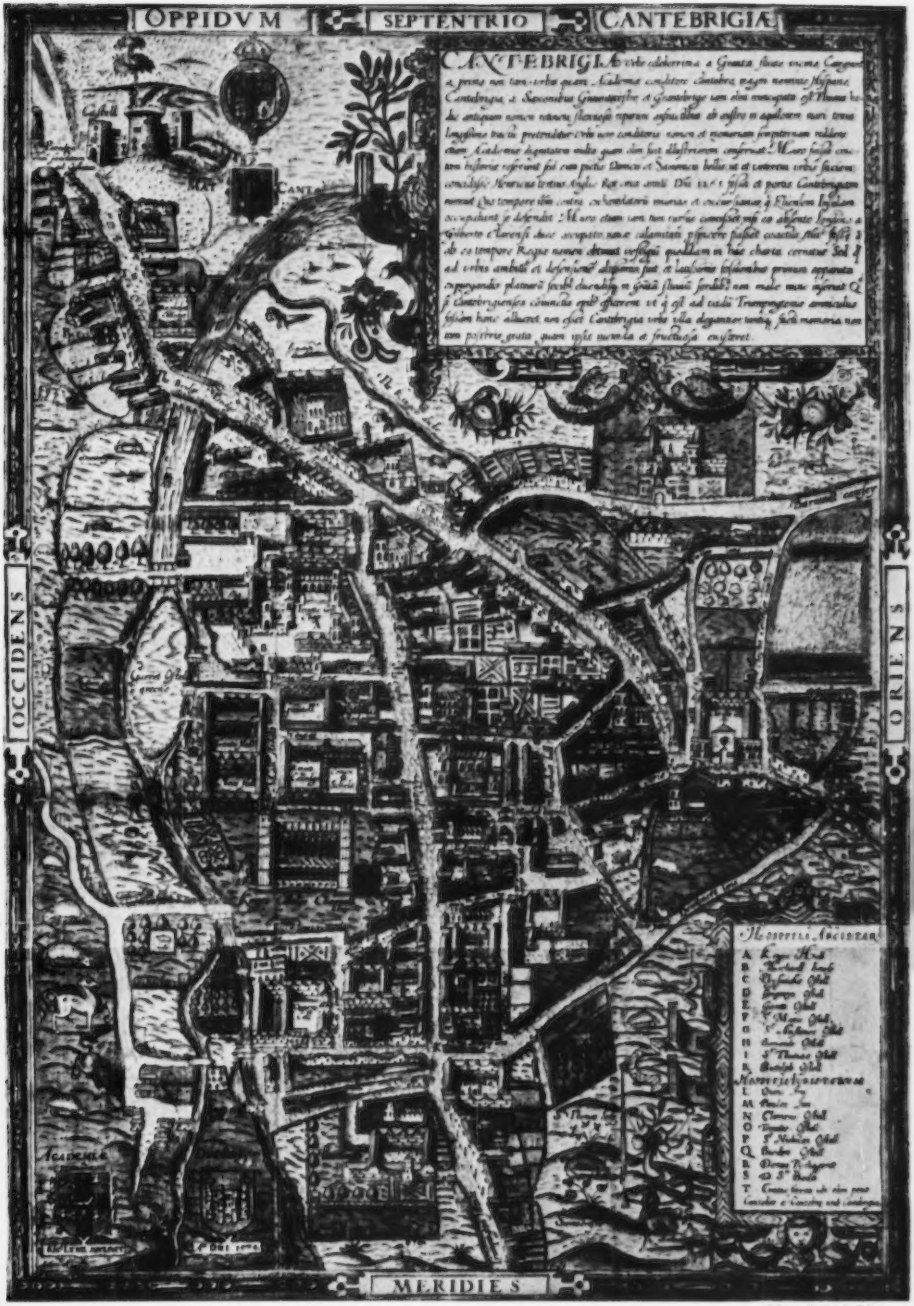
Nevertheless Saxton could hardly have accomplished his great task without the assistance of many earlier maps. That such existed there is no doubt; but in the almost complete darkness which still surrounds the history of his atlas I can only suggest two collections of regional maps, now vanished, which Saxton might have utilized. William Lambarde, the Elizabethan antiquary, was a pupil of Laurence Nowell and inherited many of his manuscripts. Among these were almost certainly some of the maps in which Nowell was so greatly interested; and it is probable that Lambarde, already map-minded, acquired or drew other local maps while compiling his great 'Topographicall Dictionarie' of England, the manuscript of which was completed in 1577 although not published until 1730. Again Holinshed tells us in his 'Chronicles' that Reyner Wolfe, the initiator of that work, "spent a great part of his time" on maps. Now Wolfe had acquired many of the manuscripts of John Leland after the latter's breakdown in health; and though I do not believe that Leland ever drew any maps except a few rudimentary sketches, his 'Itinerary' may have inspired Wolfe to collect maps for inclusion in the 'Chronicles' and, still more, in the 'Universal History of Cosmography,' on which he was busy for several years, and to employ cartographers such as Reynolds, whose mysterious reference to "our maps" has already been noted. In my introduction to the facsimile reproduction of Saxton's atlas published by the British Museum in 1936, I set out several facts which seem to indicate that it

was originally designed to be a companion volume to Holinshed's 'Chronicles,' that the national history and the national atlas were intended to illustrate each other. If this was so, it is probable that after Wolfe's death in 1573 his maps were placed at Saxton's disposal, possibly at Seckford's request, and gave him enormous assistance in the compilation of his county maps.

So far as is known, it was Seckford who recruited and paid the engravers of Saxton's maps and made himself responsible for the publication of the atlas. I suspect that after the plates had been engraved in England they were sent to the Netherlands for printing; but to arrive at definite conclusions about that, careful investigation would have to be made into the size and location of the printing-presses for copper plates existing in England between 1574 and 1611. The results of examination of the paper used for the different issues of the maps, 1574–1611, are inconclusive.[1] Before Saxton's times the only conventions in the use of symbols, lettering and decoration on English maps were those evolved by the Italian school, which are beautifully illustrated on the Lily map; but they were only imitated piecemeal and sporadically. On Saxton's maps the engravers, all of them Flemings or Dutchmen except Augustine Ryther and Nicholas Reynolds, introduced the ornate Flemish naturalistic style which had already begun to invade other branches of English art; and through them this style became firmly established in English cartography. By 1590, as already noted, even the draughtsmen of manuscript estate maps were copying the carved wooden panels, fantastic pseudo-classical ornament and conventional symbols of Saxton's engravers, although their lettering was often more varied and more delicate than that of their models. Those of Saxton's manuscript maps which have survived are much less artistic than those of some of his contemporaries, such as Ralph Aggas. Saxton was the only English map-maker in all our history who was given a coat of arms and a grant of lands by the reigning monarch. While we pay homage to him, we must not forget the debt which England owes to Seckford's patriotism and liberality. But for Seckford, Saxton might have remained an estate surveyor all his life, no better known than Ralph Treswell or Israel Amyce. After he had completed his magnificent map of England, which Seckford commissioned, paid for and published in 1583, all his maps, except the plans of Manchester (now lost) and Dewsbury, were estate maps. Apart from the Irish map of 1569, we can now add to the list of his manuscript maps published by Sir George Fordham[2] two more. These are: 'A Plate of the Mañers of Bayford and Godmanston in the Parish of Sittingbourne,' 1590, which he may have made for Sir William Gerrard, one of the notable men whose names and arms appeared at the beginning of the atlas, and 'Plan of the Demesne Lands of the Mannor of Aluethly belonging to St. Thomas's Hospital,' 1593. The first is now in the collection of Mr. Cyril E. Kenney, F.S.A., the second has only survived in a copy, made in 1782, which is preserved in the Essex County Archives at Chelmsford (D/Dth. 18).

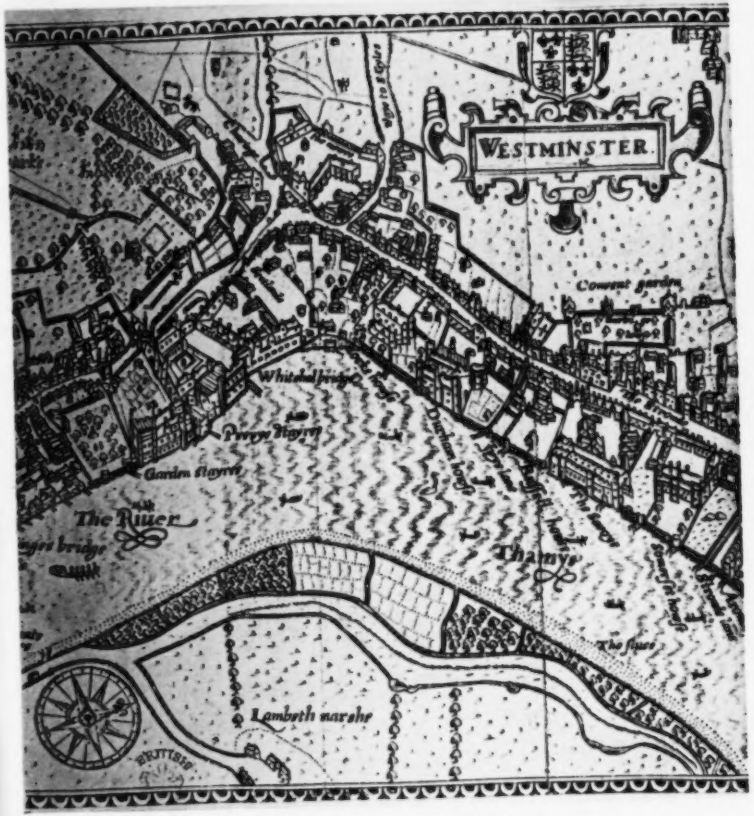
[1] There is no evidence (though it is unlikely) that Saxton's maps were not reprinted between 1611 and 1642. No dates were added or altered until 1642 and none of the early issues (after about 1590) can be dated.

[2] *Geogr. J.*, 71 (1928) 50.

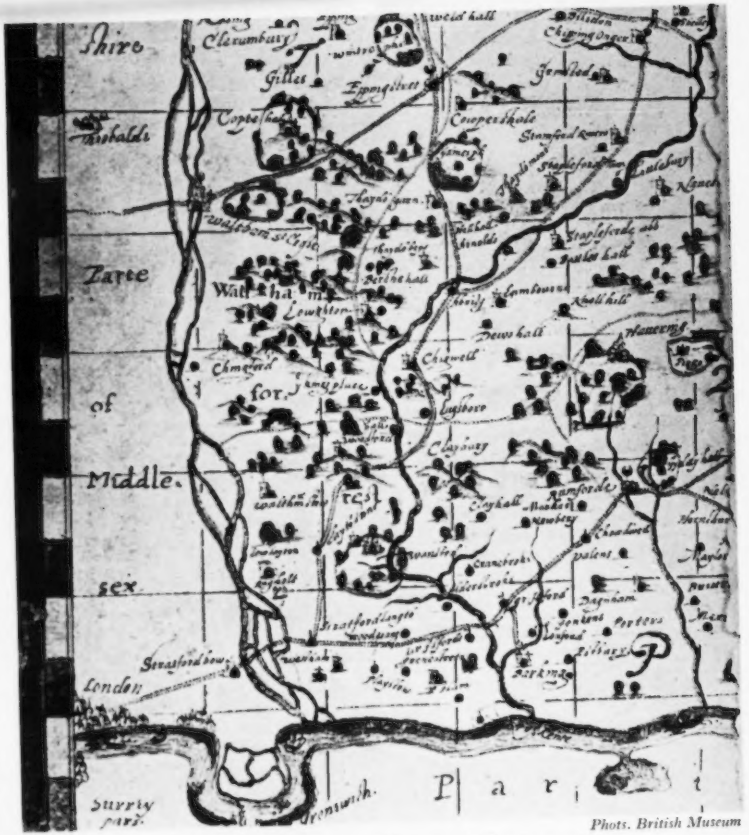


Phot. British Museum

4. Richard Lyne's plan of Cambridge, 1574



5. *Westminster, from Norden's 'Middlesex,' 1593*



Phots. British Museum

6. *Part of Norden's MS map of Essex, c. 1594*

John Norden: the first English county handbooks

John Norden was one of the greatest of early English map-makers, but a man born twenty years too late. The son of a Somerset yeoman, in 1588 he was forty years old, married and living at Fulham, an M.A. of Oxford and an attorney practising in the law courts of Middlesex. In his earlier years in the West Country he had trained himself as a land-steward and estate surveyor, and still acted in that capacity for members of the new landed gentry. In addition he was a severe and reforming Independent, one of the increasing section of the middle class, the forebears of the Puritans who, discontented with the organization and still more with the ministers of the new Reformed Church, held their own services without a pastor and used their own Prayer Books. Since as early as 1584, Norden had been composing and publishing devotional books for his fellow worshippers. They bore titles such as 'A Pensive Man's Practice' and 'The Pathway to Penitence,' and were evidently very popular, especially in London, some of them running into many editions. As a young man, possibly while at Oxford, he had been stirred by that patriotic enthusiasm for local history and antiquities which was in the spirit of the age and had led, among other things, to the formation of the Elizabethan Society of Antiquaries. During his later travels about the countryside as a surveyor and lawyer, his interest in chorography became a passion. He steeped himself in Holinshed's 'Chronicles,' Saxton's 'Atlas,' Camden's 'Britannia,' dabbled in Anglo-Saxon and collected rubbings of old inscriptions everywhere.

From 1588 to 1590 Norden was engaged in surveying monastic estates in Northamptonshire which the Queen had recently granted to Sir Thomas Heneage, Vice-Chancellor of her Household. Heneage was an eminent lawyer who had probably met Norden in the law courts. To us Norden is known only as a cartographer and as a writer of religious works; but he must have had a high reputation as an attorney, for throughout his life his most loyal friends were Justices and highly placed lawyers. It was at this time that he seems to have planned his ' Speculum Britanniae.' He had noted that Camden's 'Britannia,' being in Latin, was not for the general public, that Saxton's maps showed no roads, had no index by which places could be easily found, often included three or more counties on one sheet and that both works were large and heavy tomes. He determined to write a series of brief county chorographies illustrated by small but practical maps, to be published as duodecimo books easily carried in a pocket. Lord Burghley, obviously a most desirable patron for such a work, happened to live in Northamptonshire. By 1591 Norden had completed a manuscript description and map of that county, and having obtained an introduction from Heneage, sent it to Burghley with a dedicatory letter. This work, the first in the series of the 'Specula,' which eventually brought fame to its author, and the earliest known to contain a map by him, remained unknown and lost for three centuries. In 1938 Dr. Y. M. Goblet discovered Norden's original holograph manuscript in the Bibliothèque Nationale at Paris. Of its earlier wanderings we know practically nothing.

That dedicatory epistle is the prelude and key to the 'Speculum Britanniae.' Norden submits his work to Burghley for his approval, and adds that he

earnestly desires "more exactlye to proceede in this and all other Shires in the like or suche other order as by Yor. Honor. I shal be directed. . . . No thinge doubtinge but by godes assistaunce I shall acomplishe the same in suche sorte as shall answer my dutie to god, Her Mat^ie and my countrye, expectinge nothinge but Yor. honorable helpinge hand for my furnishing and . . . Yor. honorable countenance to grace myne endeuors." The description, which has no title, is divided into twenty sections of very much the same form as Norden adopted in his later printed chorographies. There is a description of the index of letters and numbers with which he has provided the map; an alphabet of the towns, parishes and places on the map with their index references; a list, very inaccurate, of the original Saxon place-names; lists of the Cities, Market Towns, Parishes and Hundreds of the county; of the Houses and Parks belonging to the Queen, to Noblemen, to Esquires and Gentlemen; of the Knights of the Shire; the Forests, Chases and Rivers, and finally of the "Antiquities and Memorable Places." Each of these is annotated with such historical, agricultural, social or curious information as Norden was able to collect, the last section being naturally the richest, the agricultural perhaps the most interesting to us.

The map is not remarkable in draughtsmanship and very clumsy in its title. On the whole it is a close but reduced copy of Saxton's map. But it contains the first of the many useful innovations introduced by Norden into English cartography, a marginal index of letters and numbers. He has been credited with the invention of this, which has been in general use ever since; but it had already been used on Continental maps as early as 1524. Through the resultant squares covering the map this also provided a most convenient scale, the side of each square being 2 inches long. In the text Norden included an excellent bird's-eye plan of Higham Ferrers. This, he explains, was not original but a copy of an old plan; but he suggested to Burghley that "it might be expedient that the most principall townes, Cyties, and castles within euery Shire shoulde be briefly and expertly plotted . . . as at this day they are." This suggestion he later carried out in his 'Middlesex' and his 'Surrey.' Burghley's sole response to Norden's appeal was to obtain for him a Royal "passe" or warrant, enjoining Justices of the Peace and officials all over the country to assist him in his surveys.

Northamptonshire had been a trial piece. The text was both meagre and dull. Norden must have realized that both as a cartographer and an historian he was still a mere beginner. But he had all the austere determination, ambition and capacity for hard work characteristic of English nonconformists, and he had convinced himself that his projected work would be one of national importance, more than a rival to Saxton's 'Atlas.' Accordingly he gave up most of his work as an attorney and surveyor, and devoted himself almost completely to the 'Speculum.' By the next year, 1592, he had completed 'Speculum Britanniae, the First Parte. An Historical and Chorographical Description of Middlesex.' But he could find neither a patron nor a publisher. Seckford was dead, Saxton's maps were still selling well, and engraving maps in copper was a process of which English printers still fought shy. Nothing daunted, he published the book at his own expense in 1593, employing Pieter van den Keere, a Fleming, to engrave a map of Middlesex

and delightful bird's-eye plans of London and Westminster (Plate 5). He dedicated it to no less a person than the Queen. At the last moment he received a substantial contribution to his expenses from a legal friend, Sir William Waad, who was Clerk to the Privy Council and a generous patron of geographical enterprise. Middlesex is incomparably superior in every way to Northamptonshire. Norden knew his Middlesex and its cities extremely well (one likes to think that he studied them on innumerable walks during the years when he was training to be a lawyer); and his text is a mine of information, especially about London. Its value and interest are however very greatly enhanced by the map and plans, for van den Keere was one of the finest map engravers in England at the time. With a marginal scale the map contained two other new features—the principal roads, making it the earliest engraved English county map to show roads, and an ingenious table of symbols for Market Towns, Parishes, Hamlets, Bishop's Sees and the like. We have noted the use of symbols on the "Lily" map; but this is, I think, the earliest appearance of one of those lists of "Characters" which have formed part of English maps ever since. Van den Keere's charming plans were small, but they are deservedly the best known of Norden's productions and have been copied many times because they represent London and Westminster and their principal streets as Shakespeare knew them. They were copied by Speed on his map of Middlesex in his 'Theatre of Great Britaine and Ireland' (1610–12), and through that they became well known.

The Queen had replied to the dedication by granting Norden a privilege to be the sole publisher of the work and a warrant appointing him "to travel through England and Wales to make more perfect descriptions, charts and maps." He was already busy. By 1594 he had completed 'Speculi Britanniae Pars: an Historicall and Chorographicall Description of the County of Essex,' and sent copies to Burghley and to another possible patron, the young Earl of Essex, the Queen's favourite and just then a centre of popular attention. Neither however was prepared to finance its publication, and since Norden had already spent too much on the 'Speculum' this work remained unpublished until 1840, when Sir Henry Ellis published Burghley's copy for the Camden Society. Lord Essex's copy is now in the British Museum (Add. MS. 33,769). The map in it (Plate 6) is much superior to the other, for in addition to Norden's earlier innovations it has a list of the county Hundreds and is beautifully drawn and coloured, forming a remarkable contrast to the author's first clumsy county map, Northamptonshire. Work on the 'Speculum' being now held up by lack of money, Norden determined to turn his newly found skill as a cartographer to profit. Between 1594 and 1596 he published maps of Surrey, Sussex and Hampshire on a much larger scale and in a more decorative style than his earlier works. These are all now extremely rare, and must have been published in small issues. This Society is fortunate in possessing the earliest known issues of all of them. Indeed, even for these Norden had to obtain financial help from his friends. Surrey (1594), engraved by Charles Whitwell (a pupil of Humphrey Cole) at the expense of Robert Nicolson, bears the arms of William Waad. Sussex [1595?] was engraved by Christofer Schwytzer, and bears the "Opera Mundi" shield of William Sanderson, a wealthy merchant and well-known patron of geographical undertakings.

Hampshire [1595?] has survived only in copies published from the original plate, with slight alterations, by Peter Stent and John Overton. Stent rendered signal service to students of the history of cartography by collecting the copper-plates of a great many important maps published between 1593 and 1603, of which no copies now survive, and issuing, *c.* 1642–63, reprints of them with few or slight alterations. Overton acquired Stent's business and stock in 1663; and certainly reprinted Hampshire before 1670, and frequently thereafter. These three fine county maps show Norden's usual improvements, but roads are only marked on Surrey. On that of Sussex, remembering his plan to depict the county towns, he introduced an excellent bird's-eye plan of Chichester. Speed again copied this in his 'Theatre.' Plans of county towns formed a regular feature of county maps until well into the nineteenth century, and I like to think that they originated with Norden. Sanderson helped also to pay for the publication of Hampshire, but Norden's manuscript draft of this still exists.

Norden was now in dire straits for money, and relying upon the favour of Princes, he sent a beautifully drawn volume containing copies of all his county maps except Northamptonshire, with the addition of maps of the Isle of Wight and the Channel Islands, to the Queen in 1595, with a pathetic letter describing his plans, labours, sacrifices and disappointments. I do not know that he even received an acknowledgment. This volume is now one of the treasures of the British Museum (Add. MS. 31,853). The maps of Middlesex, Surrey and Sussex are missing, presumably taken out for the engraver. Those of the Isle of Wight and the Channel Islands have never been published. 'A Preparatiue to the Speculum Britanniae,' published in 1596, was an explanation and vindication of that work. It was more. So far as I know, this is the earliest English work in which the problems of a county cartographer are discussed. Norden writes with insight and refreshing common sense. In an atlas, county sheets should be of the same size, even if that should give a variety of scales; space is seldom available to show latitude and longitude; geographical north is preferable to magnetic; local miles should be observed in surveying, but later reduced to statute; Italian miles as used in England are described, but statute preferred to them, and so forth.

During these years the main support of Norden and his family seems to have been such moneys as he received from booksellers who published or reprinted his religious works. These he turned out with extraordinary fluency; many were probably composed in the inns where he spent the evenings while busy on his surveys. All of them were dedicated to influential people, for Norden evidently felt that it would be wise to have a wealthy nobleman on whom to fall back in case the Deity proved slow or forgetful! In the private prayers composed for special occasions he often reaches real dignity and eloquence; in his political-religious pamphlets, such as 'A Christian Comfort and Incouragement unto all English subjects, not to dismaie at the Spanish Threats' (1597), his fanatical hatred and fear of Papists, Spaniards and the Irish led him into foolish ranting. In the last he harps on a favourite theme, the wickedness of contemporary England, and solemnly warns his countrymen that unless they repent of their manifold sins and reform themselves, they are doomed to be conquered by Spain. In the same year he brought out 'The

Mirror of Honor,' to reform the morals of the English soldiers who had returned from fighting in the Netherlands, in Ireland and against Spain. But as he informed them that "they began not at the feare of God, but yeelding their mindes captiue to sinne, came conquered into the field," the comments of any of them who read the book must have been ribald.

In 1597, possibly having made some money through the sale of 'A Christian Comfort' and devotional books, Norden returned to the 'Speculum.' In that year he completed two manuscripts of a description of Hertfordshire, one dedicated to the Queen, the other to Burghley. In the dedications to these Norden revealed at last the plight to which the 'Speculum' and the promises of the mighty had brought him. To the Queen he wrote, "I was drawne unto them [*i.e.* to prepare the volumes of the 'Speculum'] by honorable Counsellors and warranted by your royall fauor, I was promised sufficient allowance and in hope thereof onlie I proceeded. . . . By attendaunce . . . and travaile in the business I have spent aboue a thousand markes and fiue years time. . . . Onlie your Maiestie's princelie fauor is my hope without which I myself most miserablie perish, my famile in penurie and the work unperformed." His letter to Burghley refers to letters expressing approval of the 'Speculum' and to promises of gifts of money which were never fulfilled. As a semi-professional preacher Norden had a tendency to exaggeration; but even if allowance is made for that, it is clear that for years he had been most shabbily treated. Burghley's reply to this appeal was to die (1598), while the ageing Queen remained silent and indifferent. Norden, with characteristic determination (or was it folly?), published 'Speculi Britanniae Pars. The Description of Hartfordshire' at his own expense in 1598, securing one of the best engravers of the time, William Kip, to execute the map. I should like to suggest, though I cannot prove, that our present symbol for a battlefield, two crossed swords, derives from the picture of the Battle of Barnet on this map, where two ranks of swordsmen clash. The text, like that of Northamptonshire, Middlesex and Essex, gives an account of the county agriculture and industries which even now is interesting.

But not financial disaster alone now overtook Norden. Some two years earlier he had joined the adherents of the Earl of Essex who had, strangely enough, come to be regarded by the Puritan party, especially in London, as their champion against the succession to the Crown of the Infanta of Spain. To Essex Norden had dedicated 'The Mirror of Honor,' and in 1599 when the former was sent to Ireland as Lord Deputy, he had published an eloquent 'Prayer for the Prosperous Proceedinge and Good Success of the Earl of Essex.' But Essex's failure in Ireland, his disobedience to the Queen, his imprisonment, rebellion and execution, brought arrest and execution to some of his followers and danger to the rest. Norden's connection with him was of course well known to everybody, including Burghley's son, Sir Robert Cecil, one of Essex's inveterate enemies. When therefore in 1599, Norden applied to Cecil for a renewal of his warrant to survey, it was refused. He appealed in a letter similar to that to the Queen of 1597, saying that without Cecil's favour he, his wife and "poor children" would be undone for ever. Then, instead of lying low until the trouble blew over, he perpetrated a foolish lie, writing to Cecil, "I was unfortunatelie mistaken for another of my name, and Her

Majestie (upon surmise) enfourmed againste me, I being innocent, under couller of another Norden, I know not in what guiltie. The Norden pretender was a Kentisman, I borne in Somersetshire." Evidently he hoped that the Queen and Salisbury could be persuaded that John Norden the author of the 'Speculum Britanniae' and John Norden, author of 'A Prayer for the Earl of Essex' were different men. He was not of course believed, and for a long time was out of favour with the government.

Such was the ignominious end of the 'Speculum Britanniae,' the grandiose work Norden had begun ten years earlier. Although it brought him suffering and sacrifice, it made him an expert in cartography, while it introduced radical improvements in English county maps—a marginal scale and index, the marking of roads, the development of clear symbols for all important features, and useful insets of plans of county towns. After the Queen's death he was restored to favour, and from 1603 to 1625, when he died, he worked mainly as a civil servant, surveying and mapping the lands of the King and of Prince Charles in the Duchies of Cornwall and Lancaster. I have no space here for that period, but his most notable works, apart from devotional books, were his 'The Description of the Honor of Winsor,' illustrated with magnificent maps, which he completed for James I in 1607 (B.M. Harl. MS. 3749), his books 'The Surveyor's Dialogue' (1607), and 'England: An Intended Guyde for English Travailers' (1625), which contained triangular tables of road distances between county towns. The last, as you know, have been a feature of English maps until fairly recently; but I hesitate to support the prevailing opinion that Norden was the first to invent them.

In the early eighteenth century various manuscripts by Norden were in circulation among antiquaries. 'Speculi Britanniae Pars Altera: A Dilineation of Northamptonshire,' a description without any map,[1] dated 1610, was published in 1720. It was dedicated to Sir William Hatton, then a county notable. It is characteristic of Norden's attitude to his patrons that he suppressed any mention of the earlier work in his letter to Hatton, writing that, being in that county, he took the opportunity to pay his respects to the latter. Until Dr. Goblet's discovery at Paris in 1938 this was naturally believed to be Norden's only description of Northamptonshire. The text is similar to that of the Paris manuscript, if anything more meagre. In 1728 Christopher Bateman published 'Speculi Britanniae Pars. A Topographicall and Historicall Description of Cornwall' in a handsome small folio edition, using the manuscript which is now Harl. 6255 in the British Museum. It is undated, but was probably written between 1606 and 1610. This is the longest and most ambitious of the 'Speculum' series, perhaps because James I commissioned it from his Surveyor of the Duchy of Cornwall. In the preface Norden wrote that he was illustrating it with a general map of the county and separate maps of each Hundred. These however were missing, so Bateman substituted excellent contemporary maps. Ever since he became Crown Surveyor, Norden had been obliged to illustrate his surveys with drawings—of buildings, bridges, coppices and the like; and this work contains thirteen drawings of the curiosities of Cornwall. The text contains competent accounts of the history of the county and of the Stanneries, their rights and duties; but the bulk of the

[1] The description originally (*i.e.* in MS.) contained maps, as its text shows.

work was compiled from Carew's 'History of Cornwall.' Norden's 'Middlesex' and 'Hartfordshire' were published in one volume, with the 'Preparatiue,' in 1723, by John Senex.

During the gloomy years after 1597 Norden seems to have taken to making, perhaps rather to publishing, drawings of the London which he knew so well and where he had so many friends. He had by then moved to Hendon, where he spent the rest of his life. The earliest known of these views is entitled 'A View of London Bridge from East to West by John Norden.' I have never seen a copy of the original engraving which must be extremely rare, but a photostat of it in the Map Room of the British Museum, the donor of which I cannot trace, is dated conjecturally as 1597. Sir Richard Saltonstall, to whom it is dedicated, was Lord Mayor in that year. It is a crude, inartistic piece of work which may well be by Norden, who at that time had no training in drawing views. Many small boats are shown in the river, one of which has capsized. Below is a brief text describing the Bridge. A later reproduction from the same plate but with the lower part removed so that much of the foreground is absent, seems to be fairly common. The dedication to this is to John Gore, who was Lord Mayor in 1624, and the printed description below is much longer and more historical. This bears the Royal arms and those of London engraved near the top. Above Norden's signature appears a mysterious legend, "I described it in the time of Queen Elizabeth, but the Plate hauing bene neere these 20 yeares imbezled and detained by a Person, till of late unknowne, and now brought to light in your most happy . . . Mayoraltie, I thought it my Duty to present it first unto your Honourable view," etc. In order to fit in with all the facts this version should have been published about 1624; but the style of engraving and printing and the absence of a watermark in the paper incline me to date it at about 1710, a period when Norden's works were being reprinted by antiquaries.

A far more elaborate work, entitled 'Civitas Londini. This description of the most Famous Citty London was performed in The yeare . . .1600 . . . By the industry of John Norden,' etc., seems to be known only in a single copy in the Royal Library at Stockholm. The reproduction kindly presented to the Map Room of the British Museum by the Royal Librarian reveals this as a large work in four engraved sheets pasted together. The central sheet bears a large view of London taken from about the point on the south bank of the Thames which was used by Visscher, Hollar, Merian and others, with the title quoted above. Flanking this are the familiar bird's-eye plans of London and Westminster from Norden's 'Middlesex,' and along the bottom is attached a strip bearing a large and handsome engraving of an official procession, in which a dignitary on horseback bearing a mace is preceded by musicians and a sword bearer and followed by other horsemen. The whole history of this composition needs careful investigation. The central plate bearing the view is clearly not in its first "state," for it shows signs of having been worked over considerably; the plans of London and Westminster are re-engraved in a style differing slightly both from that of van den Keere's originals and that of Speed's engraver; the fields and boats are sometimes different from those on the original and the list of streets is longer; and I cannot find any source for the engraving of the procession, which seems Flemish or German in style. Nor

personally do I believe that the view is Norden's own work. It is unlike, and more elaborate than any of the numerous drawings which he made after 1606 to illustrate his surveys for James I. Indeed, he uses here the words "Performed by" which he uses nowhere else and which at that time generally meant "revised" or "altered by." It was probably copied from one of the prototype views of London from the south bank of the Thames which seem to have been in existence before 1600 and to have been utilized by many artists. The identification of these prototypes and the arrangement of later views such as this according to their sources is a task which we must leave to the group of students connected with the Guildhall Library, who are now working on early views of London. At a guess I would put the date of this Stockholm composite work at about 1615. It seems connected with 'A view of London in eight sheets, having at bottom a representation of the lord mayor's show, all on horseback,' attributed to Norden by Bagford and Gough but already lost in Gough's time. There are however differences, *e.g.* in size, which are difficult to explain. An issue of the central sheet bearing Norden's view is in the Department of Prints and Drawings at the British Museum. This has been worked over very much, the cartouche of the plan of Westminster adjoining the view in the Stockholm version has been partly erased and part of another cartouche substituted. The date of this might be as late as 1645. Here again is a task for the curious student.

Norden is also associated with a rare anonymous guide to London, 'A Guide for Cuntreymen in the famous Cittey of London, by the help of which plott they shall be able to know how farr it is to any street. . . . Anno. 1653.' This consists simply of the bird's-eye plan of London from Norden's 'Middlesex," printed from the original plate with the name of van den Keere and the date erased, and the above title and an enlarged list of streets added. It is almost certainly the edition which Gough dates in error at 1613. It was published by Peter Stent, already referred to as the saviour of the copper-plates of many old maps.

Two maps of Ireland

Norden's name is connected with two manuscript Irish maps. The first, which is in the British Museum (Cotton. Aug. I. ii. 44), is a large vellum map, unsigned and undated, of the Six Escheated Counties of Ulster. Most carefully drawn, coloured and inscribed, it shows the confiscated estates and their areas, the names of all the grantees, distinguishes Bishop's land, Glebe land, Abbey land, etc. In all the Museum catalogues before 1844 it was left without date or author, but in that of 1844 it was definitely ascribed to Norden and dated 1605–6. I find that it was ascribed to him only on account of the handwriting, which palaeographers, after careful examination, decided was his. Nevertheless I submit most humbly that this map is not in Norden's hand, while there is evidence of another kind that he knew extremely little about maps of Ireland. The second map, now in the Public Record Office (M.P.F. 67), is a large coloured manuscript map of all Ireland in Norden's hand, entitled 'A Description of Ireland' and accompanied by a volume, also in his hand, containing an account of the country (M.P.F. 65, 66). The Public Record Office date, this at about 1610–11. The preface is addressed to Salis-

bury, who may have commissioned the work, although I think that Norden probably compiled it to make favour with him. In the preface Norden describes his labours in compiling the map. Although he had assistance from Sir Francis Shane and Mr. Hambledon for various areas, he had "met many difficulties in the tedious conferring of so manie disagreeing plotts together," and writes, "Neither my weake skill nor greatest industrie at this therde essay can bringe this confused Plot to the right Shape and true proportion," and so forth. This is certainly not the language one would expect from the author of the fine map of the Six Escheated Counties already mentioned; and seems to prove that he neither could nor did draw that map. Be that as it may, the map of Ireland which his "weake skill" finally produced was nothing but an almost faithful copy of Boazio's Ireland of 1599, even to the doubtful superfluous legend about the English first landing at Bonnagh Baie, Wexford (see Appendix). Boazio and Norden was each in his own way an adherent of the Earl of Essex, and Norden probably secured a copy of the former's map as soon as it was published. The text follows generally the scheme adopted in the 'Speculum,' though more detailed. It covers the "Principall Towns, Chief Castles, Fortes, Earldoms, Baronies, Seignories, and Territories with the names of Men of Chiefe Note, the Hauens, Bays and Harbors" in Ireland. On examination however it proves to be a pure compilation from the various descriptions of Ireland recently published. From State Papers, Reports of the Historical Manuscripts Commission and especially from his own numerous surveys, we now know a great deal about Norden's activities between 1605 and his death in 1625; and I have found no indication that he ever set foot in Ireland.

When Norden died in 1625 he was aged about seventy-seven and had led a life of incessant toil. Yet his estate was valued at less than £30.

APPENDIX

Baptista Boazio's Irish maps

An Elizabethan map-maker around whom some confusion has gathered is Baptista Boazio. His earliest known work is a sea-chart, 'the famouse West Indian Voyadge made by the English fleete (Sir Francis Drake Generall) . . . 1585 . . . 1586. . . . By Baptista B.', showing the outward and homeward voyages and Drake's call at Roanoke to take off Raleigh's starving colonists. Engraved in the Netherlands, it was published in the edition of Walter Bigges' 'Summarie and true Discourse' of the voyage printed by Richard Field in 1589 and in Roger Ward's edition of 1589, but in no other edition of that work. In 1591 Boazio drew a map of the Isle of Wight which was no more inaccurate than others of that time. This reveals him as a mature draughtsman, calligrapher and colourist in the style of the Flemish school, with a taste for decoration on his maps, especially for graceful sailing ships. In 1595 he drew a map of the siege of Geertruydenberg in Holland in which English troops under Sir Francis Vane were engaged. Vane may have employed him as a military map-maker; but all we know is that Jan Blaeu published an engraved version of it in his 'Toonneel der Steden' in 1649. By the next year Boazio was again associated with the high seas and raids on the Spaniards, this time apparently as a dependant of the Earl of Essex; for his next two known maps depict the operations at the sack of Cadiz in 1596 and the "Island Expedition" to the Azores in 1597. In both of these Essex was a leader, and Boazio mentions him on each map. That showing the

victory at Cadiz was promptly engraved by Thomas Cockson, one of our finest early artists in copper, but copies are now extremely rare. From 1597 we have another map by Boazio which is different from any others by him. It represents Falmouth and the neighbouring country and waters up to Truro, and is on a large scale, permitting the insertion of the principal private estates and mansions and the names of their owners. Boazio may have been commissioned to prepare this by one of the Killigrews of Arwenack—but there is no inscription to support this guess.

Thereafter he turned his attention to Ireland. In the years 1597–1612 there was an intense interest in Ireland among the English of the upper class, for large grants of land there were being made by the government, and during the period 1580–1603 more maps were drawn of that country and of its provinces and districts than of English regions. As practically all of them were made for official purposes they were never published, but many are still preserved at Trinity College, Dublin, in the British Museum, the Public Record Office and Lord Salisbury's Library at Hatfield. Boazio's map of Ireland was much his most ambitious work, and through it he has attained fame. Very large and printed from two plates, it was dedicated to the Queen, lavishly coloured and adorned with a coat of arms, elaborate cartouches, ships and sea-monsters, some naïve legends and a masterpiece of doggerel verse. It was "dilligently and truly collected & partly surveid by Baptista Boazio," the engraver was Renold Elstrack, a young Fleming who later engraved many English maps, and the publisher John Sudbury, afterwards the publisher of Speed's 'Theatre.' The map bears no date, nor is it mentioned in the Stationers' Register. The latter fact and the extreme rarity of copies may indicate that it was suppressed lest it should come into the hands of Spaniards. At any rate its merit was soon recognized in the Netherlands, where it was published, with small alterations, in Vrints' edition of Ortelius' atlas ('Parergon') in 1602 and subsequent years, replacing Ortelius' old and much inferior map of 1573.

About 1904 Professor Robert Dunlop found a copy of this map, which he believed to be unique, in the Hardiman Collection at Trinity College, Dublin, and described it in an invaluable paper on sixteenth century Irish maps published in the *English Historical Review* in 1905. From internal evidence he dated it conjecturally at 1578–80, and upon that assumption he concluded that Boazio was the first man to make a proper survey of Ireland and that all the maps of that country produced during the following twenty-two years, including that published by Mercator in his 'Atlas' of 1595, were based on Boazio's. Two later manuscript maps of parts of Ireland in the same collection which bore Boazio's name confirmed him in that opinion. His conclusions have been accepted, and elaborated, by all subsequent writers on Irish cartography.

In 1937 the British Museum acquired a copy of Boazio's Ireland (Maps C.2.cc.1), and I had an opportunity of studying it together with a copy printed on silk which is in Lord Lytton's library. I have been able to date it definitely at mid-June, 1599, and to show that, so far from being an original work, it was copied in all essentials from Mercator's map of 1595 and from a much poorer map published by Jodocus Hondius and Pieter van den Keere in 1591, of which the only known copy is in the Linenhall, Belfast. In many details however it is less accurate than Mercator's map; some of Boazio's lakes, islands and river-systems appear to be pure fictions. Incidentally I found that Elstrack, the engraver, was only nine years old in 1580, Professor Dunlop's date for the map. As Essex was in Ireland as Lord Lieutenant from April to September 1599, we might suppose that Boazio accompanied him and made his map then; but the evidence shows that the latter remained in England. Indeed the drawing of the

map must have been completed some time before Essex went to Ireland, since the engraving of the plates, printing the maps and colouring them by hand would all be slow operations at that time. The other two Irish maps signed by Boazio are a manuscript plan of the siege of Kinsale in 1601 in Lord Salisbury's collection (Hatfield. Maps II.38) and a large and detailed but undated manuscript map of the northern half of Ireland in the British Museum (Cotton MS. Aug. I. ii. 30). I find that both are copies of works by other men. The Kinsale map is accompanied by a letter from Boazio to Sir Robert Cecil (9 Jan. 1602), in which he writes "a gentleman not long since coming from the siege of Kinsale delivered me a copy . . . which I now . . . have somewhat roughly performed to send to you." The "gentleman" was almost certainly Paul Ivye, already mentioned as a government surveyor in Ireland at that time. The second map Professor Dunlop regarded as the culmination of Boazio's pioneer labours in Ireland and dated, I think correctly, at 1602–3. It is certainly far better than the northern Ireland on Boazio's map of the whole country; but that is simply because it is not original. It is a straight copy of an excellent map drawn about 1601–2 by one Mr. Griffin, master of the ship *Tramontane*, which is also in the Hardiman collection (1209/14).

Yet on the whole Boazio was more honest than not about his maps. Historians have read too much into his signature. He claimed none of them as the result of his personal survey and observations except Ireland and Falmouth. On the maps of Kinsale and northern Ireland he simply wrote "Baptista Boazio made this Plott," and on those of Cadiz and the Azores, "Baptista Boazio made this description"; only on the map of Falmouth did he write "Surveyed by." On another map drawn by him about 1603 and showing north-western Ireland, which recently came to light at the sale of Lord Dartmouth's collection, he has written "truly collected and observed by Captain John Baxter. Finished by Baptista Boazio." But on Ireland he let himself go. Although he inserted some insignificant places captured by Essex, such as Woodstock Castle, "partly surveid" was a euphemism for "partly invented." Among other fantasies Boazio showed an "Elstrakes Ile" and a "Baptistes rock" off the north coast, marked twenty-three islands in Lough Neagh, gave the Shannon tributaries from three western lakes and inscribed the name of Rowland Whyte, one of Essex's friends, across most of County Down.

Boazio's custom of copying other men's maps, taken with the fact that I have nowhere found his name in the literature and lists of personnel of the expeditions to the West Indies, Cadiz and the Azores, suggests that he did not accompany any of them. If he had, a man of his profession and importance to the expeditions could hardly have failed to be mentioned. I suggest that he drew the West Indies, Cadiz and Azores maps comfortably at home from information supplied to him, just as old William Hack drew his buccaneering maps some eighty years later. Nor is there any evidence that he ever visited Ireland. All we know is that after 1597 he began to make maps of that country and studied all the sources, good and bad, that he could find. In the letter which he sent with the map of Kinsale he offered to send Salisbury further Irish maps if desired; which means no more than that he wished to ingratiate himself with Salisbury and was in touch with map-makers in Ireland such as Ivye. At the beginning of 1603 he was nowhere near Ireland. He was completing a map of Sherwood Forest for the Duke of Rutland, who seems to have given him occasional employment after 1599. Thereafter we hear no more of him. Professor Dunlop has suggested that several late sixteenth century manuscript plans of Irish towns preserved in the British Museum might be by Boazio. None of them is signed and none is in his hand.

DISCUSSION

Afternoon Meeting, 26 April 1948

Before the paper the CHAIRMAN (Mr. J. N. L. BAKER, of Jesus College, Oxford) said: The task of taking the Chair at a lecture by Dr. Lynam is a very easy one because he needs no introduction from me, and therefore I will ask him at once to read his paper.

Dr. Lynam then read his paper.

Professor E. G. R. TAYLOR: I should like, first, to thank our lecturer for a paper of extraordinary interest, not only of scientific interest but of rich human interest. I think we shall wish to congratulate him too on the skill with which he has woven so intricate a subject into a discourse which even those not familiar with the history of maps and surveying could readily follow.

In Thomas Digges' 'Pantometria' where he first describes his father's theodolite, at least in the woodcuts, the name is transferred. There are two instruments, one a "geometrical instrument" and the other the theodolite, and the instrument we now know as the theodolite is there not called a theodolite, so there may be some matter of doubt there. I should however like to put in my word on behalf of Aggas, who was an extremely accurate surveyor.

A point of great interest is the relation of the country surveyor to the estate surveyor and the fact that so many of these people ended up in the Herald's Office, where some nice pleasant jobs were going which did not require too much effort. In that connection I should like to mention, although he is right out of the period treated by the lecturer, an important person in our history of geography in general, namely, Gregory King (1648–1712). His father was a surveyor and the lad who used to help his father with surveys became a clerk to Sir William Dugdale and later helped in the mapping for Ogilby's famous 'Road Book.' Gregory King was one of those who ended up in the Herald's Office, and we owe to him an extremely important document entitled, 'Natural and Political Observations and Conclusions upon the State and Condition of England,' published in 1696. This document, written towards the close of the seventeenth century, gives us the first estimate of the population of this country in respect of various classes of occupation, also the acreage of arable land and land under various crops. In other words, he gives the beginnings of the geographical survey of this country in terms of figures.

One other point has emerged from this lecture which is so full of meat, namely, the fate of people who wanted to make English atlases. Christopher Saxton got on pretty well, but John Norden had rather a sad history. Moses Pitt, too, tried to make a great atlas worthy of our country and was helped by certain Fellows of the Royal Society, but his project failed. He went to prison, but not on that account. At the present day we have a project for a National Atlas sponsored at first by this Society and now also by the Royal Society; how this work should proceed is up to those who control our finances. I have been meditating all through this lecture as to whether I cannot start, as John Norden did, writing religious books in order to get a sufficient amount of money to furnish the atlas!

Just one other word. In speaking of Aggas and the estate surveyors we have seen that many of these former map-makers have left examples of their work not only in county maps but in estate surveys, and it is important that those estate surveys, many of which are lying in muniment rooms or in estate surveyors' offices, should be preserved and made available for study. They are of extraordinary scientific, artistic and historical interest, and I commend those who

have influence or who happen to be in solicitors' or other offices to do their utmost to bring these surveys to light. A movement has been set on foot by the Master of the Rolls to preserve such maps and records and use them for scientific, historical and literary purposes.

Miss E. M. J. CAMPBELL: I should like to join with Professor Taylor in congratulating the lecturer and to say to the young geographers present that they must not condemn these early surveyors of whom we have heard because they did not bring out the form of the ground on their maps nor give exact heights; to have done so would have called for more precise instruments than were available to them. Even as late as the beginning of the nineteenth century there was not sufficient information concerning form of ground and height to enable precise maps to be drawn. You may recall that Whymper, writing of the French Alps in the 1860's, says that the exact heights of peaks are not available to mountaineers.

The Rev. O. R. WALKEY: I should like to ask whether the proposed new English Atlas will be subsidized. When I was compiling information about the Amazon Basin some twenty-five years ago the Royal Geographical Society very kindly gave me the run of their map room and I came across a German map of the region which was most useful. This map was coloured according to the depth of the rivers at various seasons of the year. The German professor would go out there and take soundings of the river at various times. There was a purpose in such maps and an amount of information afforded which is sadly lacking in British maps in general.

A FELLOW: Can the lecturer tell us anything about the hydrographic charts of Richard Poulter, William Borough and others in the latter part of the sixteenth century? I think the men of those days are worthy of mention for the work they did.

Dr. LYNAM: First of all I want to thank Professor Taylor very sincerely for what she has said. I am the last to accuse Ralph Aggas of inaccuracy. He was for his period an extraordinarily accurate map-maker. He said, in 1596, that he had been using the theodolite for some years; I think that it might have been that what he was using was the circumferentor. He was, as I have noted, a boaster, who liked to make out that he was more advanced in his methods than other surveyors. Norden described both the circumferentor and the theodolite in his 'Surveyor's Dialogue' (1607); but he seems to have used the first instrument by preference and perhaps also from necessity. The circumferentor was certainly the surveyor's favourite instrument down to 1665. As for my lantern slide showing the vertical semicircle of a theodolite made by Humphrey Cole in 1569, that was taken from a valuable essay on Cole and his work published by R. T. Gunther in *Archaeologia* in 1927. The horizontal circle and quadrate belonging to this are unfortunately lost; and I agree with Professor Taylor that the collector who presented the vertical semicircle to the Ashmolean Museum may have "refurbished" it slightly. On the other hand, if we look at Laussedat's great work on surveying instruments, we shall find an illustration of two quite similar English instruments for observing vertical angles which date from about 1565 and are still preserved in Paris. Laussedat, like so many other Continentals, praises the English highly for their invention of the theodolite, but adds that they long delayed to use their own invention.

With regard to the third speaker, I am indeed sorry to learn that our maps of South America are so deplorably bad. As for Poulter and others mentioned by the last speaker, I have not had time to say much about charts in this lecture. Speaking from memory and cursory examination, I should say that Poulter's chart of the estuary of the Thames (1583–4) is a remarkable hydrographical

work, but was based on Dutch charts. Two of Borough's charts would repay study, but two others are only sketches of the northern seas between Norway and Greenland. He was Queen Elizabeth's Comptroller of the Navy, and Poulter also held some official post.

The CHAIRMAN: It remains for me to express the thanks of the meeting to our lecturer and to those who have taken part in the discussion. This has been an extraordinarily enjoyable and informative lecture. I should like to refer to one point which Professor Taylor made, namely, the historical importance of these maps. It so happens by pure accident that two of the maps which the lecturer put on the screen this evening are of immense interest in the history of my own college. One was a map of Oxford published a few years after the foundation of the college and is the first record that we have of the earliest of the college buildings. The second map was a portion of Norden's map of London showing the extent of Lambeth Marsh, part of which, as a marsh, was bequeathed to the College in the seventeenth century and in due course became one of its most valuable possessions. That is one small illustration of the importance to English history of the preservation of these maps, and it is fortunate that there are in this country persons like our present lecturer who are able to devote their lives to the study of these documents. He referred to one of the books written by Norden entitled 'A Sinful Man's Solace.' I would not suggest that the lecturer is a sinful man, but I am certain that studying these maps he does find solace. He has given us an evening's great pleasure and in your name I thank him very much for his paper.

GEOGRAPHY AND THE DEVELOPMENT OF EAST AFRICA

E. B. WORTHINGTON

NEAR THE MIDDLE of Lake Victoria is a small island called Godsiba, or Nabuyongo. It was the site of a naval action in the first world war, a rather comic affair between German and British lake steamers. This little island was not visited after that action until 1927, when I was one of a small party which landed there and examined it. We found it very cut off from the world and all the young people were brought along to see our white faces. The island contained however quite a flourishing little community of fishermen and cultivators. After that visit Godsiba was left to itself for another twenty years or so, but was visited again last year, when the Provincial Commissioner and two of our Lake Victoria Fisheries Officers landed there and had another look around. They reported that no significant change had taken place, and another generation of the islanders saw white faces for the first time.

Now Godsiba Island is a very unimportant part of East Africa, but I mention it as one of the few places which has not yet come into contact with European ideas. If Godsiba is left to itself for another twenty years, its little community would make a most interesting study in comparative geography and sociology. The changes which will by then have taken place in most of the neighbouring lands will be considerable, but Godsiba will still have its self-contained and self administered community of the old Africa.

Changing our perspective from this little island to the whole political region of British East Africa (Kenya, Tanganyika, Uganda and Zanzibar), we perceive at once the unfortunate fact, arising from its historical geography, that the boundaries, whether of countries, provinces, districts, or even farms, so often run along drainage lines rather than along watersheds. Admittedly boundaries sometimes have no physiographic significance, having been defined as straight lines between points, as in part of the frontier between Italian Somaliland and Kenya; but in most cases where they follow a geographic feature it is a drainage line. For the external boundary of the region there is a reach of the Daua river, a reach of the Nile near Nimule, a central line down Lake Albert, the Semliki river, Lake Edward, Lake Tanganyika and finally the Ruvuma river. At but few points do watersheds or mountains form the boundary; part of the Imatong mountains to the north of Uganda, a little stretch of the Nile–Congo watershed along the West Nile district of Uganda, Mts. Ruwenzori, Sabinyo and Muhavura, and a portion of the divide between the Luapula and Lake Rukwa drainage areas.

It is obvious why it came about that frontiers in Africa, as elsewhere, were so often defined as drainage lines. They had to be laid down when there was little knowledge about the country and few maps of any accuracy. It was necessary to define frontiers with reference to obvious features on the ground, and a lake or a river is a much more obvious feature than a watershed. It is

unfortunate that this has happened because, now that Africa is better known and is being developed, it is becoming ever clearer that the natural unit for development is not the area between two rivers, but that of the drainage basin itself, bounded by the watersheds. This must be so in all relatively dry parts of the world, where water is a main factor limiting human endeavour and proper use of the land depends so much on the control of water flow. In fact water control is, or should be, one of the essential preliminaries to development, and it can only be effected properly on the basis of the drainage area, whether it is a few hundred acres or many thousand square miles.

These two concepts: the degree of influence by Europeans, illustrated by Godsiba Island, and the drainage area as the logical unit for development, illustrated in the anomalous boundaries of the region, have somewhat dictated the examples which have been selected for consideration in this paper. Clearly it would be impossible to summarize the whole field of recent developments in an East Africa which is undergoing rapid change. There are a score or more of important subjects which would perhaps be equally good as illustrations, but I limit myself to the following topics:

(i) Lake Victoria where the three countries meet, especially the development of its fisheries.

(ii) The Lake Victoria project, including the Owen Falls dam.

(iii) The Nile in Uganda and the southern Sudan.

(iv) The problem of the wild fauna and the animal industry.

(v) The development of an inter-territorial scientific organization.

The Lake Victoria fisheries

Having participated in geographical and biological studies of the great lakes of Africa twenty and more years ago [1] it has recently fallen to my lot, after a long absence from Africa, to take part in implementing the recommendations then made. They happen to be concerned with the specialized subject of fisheries, but since geography can be dissected into a multitude of specialities, this one is perhaps as good as another to illustrate how in East Africa we are arranging developments in certain subjects on a regional, rather than a territorial, basis. But first it is necessary to digress into two technical spheres: political organization and fish.

When Michael Graham, whom I had the privilege of assisting, made recommendations [2] about the Lake Victoria fisheries in 1927 they were addressed to the three separate governments of Kenya, Tanganyika and Uganda; but through the then embryo organization of the East African Governors' Conference. Once or twice a year the three Governors gathered to discuss common problems, and they maintained a permanent secretary who at that time was an administrative officer with a big career in front of him. He has lately retired from the Governorship of Northern Rhodesia as Sir John Waddington. Now, in 1950, there are still the three separate governments of Kenya, Tanganyika and Uganda, but the East African Governors' Conference has grown to maturity and has come of age, so to speak, by being converted in 1948 into the East Africa High Commission. The little secre-

[1] *Geogr. J.* 74 (1929) 109–132, and 79 (1932) 275–297.

[2] 'The Victoria Nyanza and its Fisheries,' London, Crown Agents, 1928.

tariat has grown into quite a large thing, with the Administrator and his staff, Members for Transport and Finance, the Postmaster General, Economic, Legal and Scientific Secretaries, and so forth; and there has been created the East African Central Assembly, a legislative body, additional to the three territorial legislatures, which has general responsibility for a number of public services extending throughout the East African region. This East Africa High Commission provides the umbrella under which can be put many activities of an inter-territorial character; and among them come the Lake Victoria fisheries.

Now for the fish. The rich fishing waters of Lake Victoria have, from time immemorial, been a great asset to the dense populations living around the shores and they devised many an ingenious method for capturing fish of different kinds. In about 1905 however the white man introduced his own fishing ideas and there developed a fishery, primarily for one important and highly palatable species, *Tilapia esculenta*, with the aid of introduced European nets. To begin with, this fishery was very productive; each net during one night in the water caught an average of something like 30 fish. In the 1920's however it was observed that the catch had dropped alarmingly, and instead of an average of 30 fish per net per night, they were getting only 10 or even less. This was one of the reasons why a fishery survey was organized in 1927. We then found that the average catch of fish per net in the Kavirondo Gulf, for example, had dropped as low as 5, and our recommendations were designed to conserve the stock and maintain a permanently productive fishery. In addition, we found that in the wide open waters of the lake, where no fishing was undertaken because dug-out or plank-built canoes are incapable of operating more than 5 or 10 miles from shore, there were indications of large fish resources completely undeveloped. Mr. Graham made recommendations for further research work, designed to reveal and subsequently to develop these open water resources.

The Colonial Governments of those days had few officers and little money, and so were unable to implement these recommendations in full. Indeed, it was not possible to do much until a stimulus was given to colonial development by the Colonial Development and Welfare Acts, passed by the British Parliament in 1940 and 1945 and revised in 1949, which made available for the colonies considerable sums of money from the British Treasury. The war prevented much being done until about 1945. Two schemes were prepared in that year and subsequently financed by the Colonial Office. One was for fishery and biological research, to have its headquarters at Jinja on the north shore of Lake Victoria, but to conduct operations in due course on all the great lakes and rivers of East Africa. The other was for fishery development; that is, some means of applying the results of scientific research so that with science as a background day-to-day assistance could be given to build up a prosperous fishing industry.

Having obtained Directors for the two new services, buildings and facilities had to be provided before other staff could be appointed. This also has been successfully achieved, or nearly achieved. There is a new laboratory at Jinja for the Fisheries Research, with a group of houses and guest houses to accommodate the staff and visitors, and launches and boats for conducting work on

Lake Victoria. The Fisheries Development Service has headquarters at Mwanza at the south end of the lake and two supplementary establishments at Kisumu and Entebbe. It has three motor fishing vessels in which the fishery officers and their staff can travel, making contact with the innumerable fishing settlements and trying out new or improved methods of fishing. In due course they will be organizing the fishery, seeing that the requisite equipment is available to the industry, arranging landing points where fish can be processed and generally assisting the dense population of fishermen all round the lake.

For the research service one of the most urgent problems was to examine the fish resources in the open waters, to decide whether or not it was worth while trying to establish an open water fishery with powered craft and, if so, how it could be done. In two years' work the research officers have confirmed that large supplies of fish do in fact exist, and by the use of suitable methods of bottom fishing in open water the prospects for a flourishing industry are quite bright. The result of that has been that last autumn the Lake Victoria Fisheries Board, the inter-territorial body charged with advising the Governments, made recommendations for initiating a pilot commercial fishery in the open water and this, I believe, has now been started. In this case the first object is to provide an ample fish supply for the large amount of labour which is now assembling at Jinja to build the Owen Falls dam.

I have gone into some detail in this example, not because the fisheries themselves are of outstanding importance in the general picture of East African development, but because they illustrate our methods; filling in the scientific background, but at the same time making provision for using that knowledge to achieve greater production.

The Lake Victoria project

The supply of fish for those who will build the Owen Falls dam introduces one of the big developments of East Africa. This dam has had some publicity in the last year or two, generally under the title of "The Owen Falls Hydro-electric Project," but it is part of a bigger "Lake Victoria Project," for reasons which I will explain. The Owen Falls are situated a mile and a half downstream from the outfall of the Nile from Lake Victoria, in the heart of Uganda, all of which territory is more than 700 miles by railway from the port at Mombasa. This distance makes any form of imported fuel extremely expensive and consequently Uganda, like many other countries in Africa, relies for heat and power mainly on the most inefficient of all fuels, namely firewood. The supplies of firewood are not always adequate, even for to-day's needs, and, without giving over a disproportionate area of good agricultural land to growing it, will certainly not be adequate for the future industrial development which must be foreseen. From Uganda's point of view, the principal interest of the Owen Falls dam therefore lies in the very large amount of hydro-electric power which it will produce. When complete, the turbines and dynamos will have a steady output of 80,000 kilowatts, much more than the demand which is immediately foreseeable, and will therefore provide an ample reserve for consumption by new industrial enterprises and the like. This was the main reason why the Lake Victoria project was

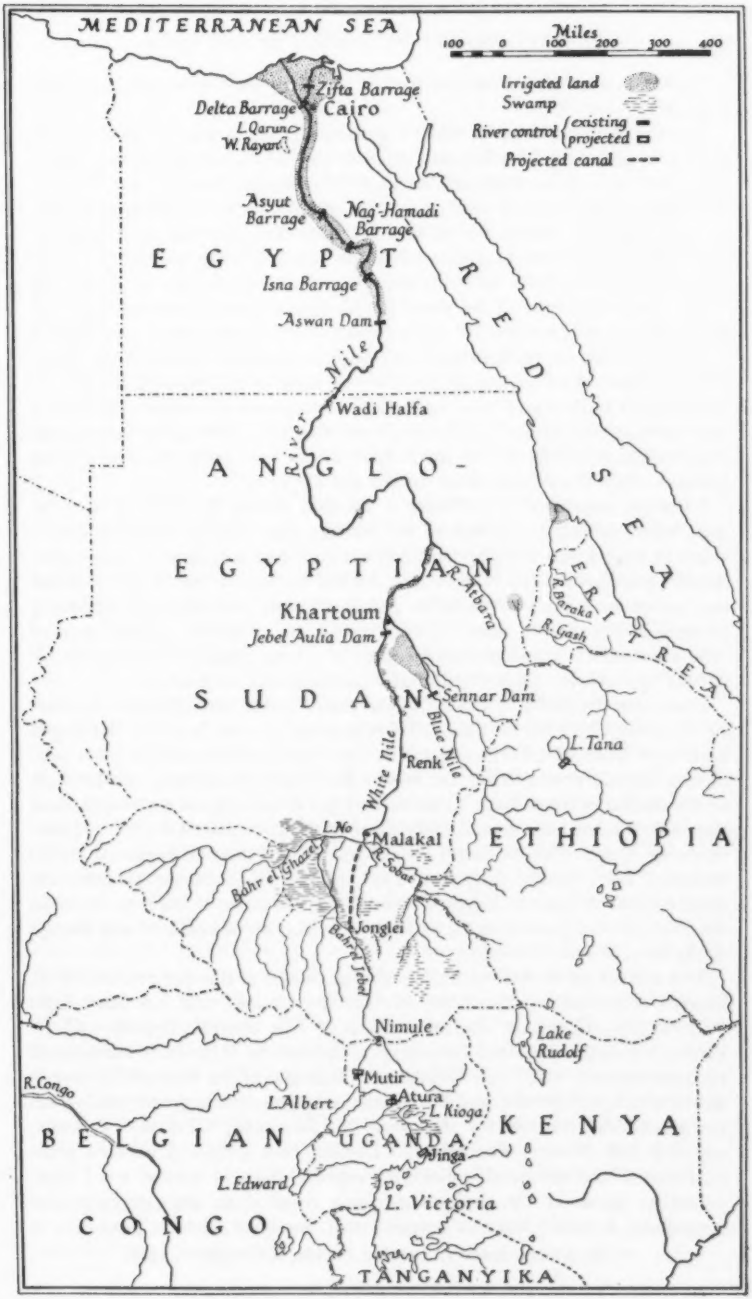


Fig. 1. Control works on the Nile

advanced in 1946 as an integral part of the ten year development plan for Uganda.

But the dam has a much wider significance than in producing abundant power, heat and light for Uganda, because the Nile is an international river. The problems of international rivers have a peculiar fascination. When a river flows successively through a number of different countries there are apt to be many rival claims for its benefits, sometimes turning into bones of contention; there are problems of water supplies for man and stock, of irrigation, of navigation, of hydro-electric power and of water pollution. So many of the big rivers of the world go through so many countries that if all the problems of international rivers were solved, a large number of nations would be living in remarkable amity with each other. Some of the international rivers flow for the greater part of their length through deserts, in which great civilizations and populations have grown up entirely dependent upon them. Such is the case above all with the Nile, drawing its waters from the mountains of East Africa, the Belgian Congo and Abyssinia, and flowing north through the deserts of the Sudan and Egypt.

I became engrossed in problems of the Nile during the latter part of the war, when Scientific Adviser to the Middle East Supply Council. Later, when in 1945 I was Development Adviser to Uganda, a country which produces a good part of the Nile's water, I could not forget the viewpoint of the user countries farther downstream and their great interest in the gathering grounds of East Africa. Surely the interests of the producers and the users of Nile water could be married in the form of a joint "Lake Victoria project," and an opportunity taken for practical international cooperation.

Damming the outlet of Lake Victoria was, I think, first suggested in print by Winston Churchill in 1908.[1] No firm projects were however developed until 1936 when detailed investigations were made on the possibilities of producing electric power below the Ripon Falls without affecting the level of, or the discharge from, Lake Victoria. In 1946 these issues were brought into line with the need for great quantities of water to be stored for the requirements of Egypt. The combined project was worked out and approved on the technical level during 1947 and 1948, at several meetings between the governments of Uganda, Egypt and the Sudan; and also at meetings between the East African governments, all three of which are affected by any change in the level of Lake Victoria.

It is not for me to deal with the technical details of this project. Dr. H. E. Hurst has worked out the theory of "century storage" and has fitted Lake Victoria into the whole ultimate scheme of Nile control; Brigadier C. G. Hawes has been appointed Hydrological Adviser to Uganda to examine all the implications; Mr. C. R. Westlake is Chairman of the Uganda Electricity Board which will develop and distribute the hydro-electric power, and which has placed the contract for the work. Sir Alexander Gibb and Partners, together with Messrs. Kennedy and Donkin, have prepared detailed plans on the civil and electrical engineering aspects. Nor, of course, am I competent to speak of the diplomacy which resulted in inter-governmental agreement. I would however mention that the Lake Victoria project is in

[1] 'My African Journey,' London, Hodder & Stoughton, 1908.

itself a great geographical development because, although the capital cost will not be very great in relation to other major works of river control, Lake Victoria will become the biggest reservoir in the world.

Apart from hydro-electric power, this huge reservoir will provide usable storage of about 100 milliard [1] cubic metres of water. The discharge down the Nile which, under the natural regime, is variable according to precipitation and evaporation in the gathering grounds of Lake Victoria, will be as near as no matter constant. This is necessary for a constant supply of hydro-electric power, and for Egypt, the prime user of the water, to know where she stands and make arrangements farther downstream to deliver the water when it is most needed for irrigation. It is calculated that, to provide a constant discharge, it may be necessary to increase the vertical fluctuation of level in Lake Victoria (about 1·7 metres under the natural regime) on extreme occasions by a further 1·3 metres, making a total vertical range of 3 metres. To meet the interests of navigation on the lake this extra range has to be provided on the upper rather than the lower side. A certain amount of low-lying land around the shore, which, including the islands, extends to about 3000 statute miles, will thus be liable to occasional inundation. A great deal of the shore line is steep and rocky so there are fortunately not many critical areas of low-lying and densely populated land where agriculture and the population are likely to be disturbed; but there is a lot yet to be done in working out a basis for the assessment of compensation.

In calculating the probable behaviour of the Lake Victoria reservoir when its outfall is controlled, and in deciding on a programme for regulating the sluices and so forth, it would be extremely convenient if it were possible to forecast the behaviour of the lake under the natural regime (Fig. 2). C. E. P. Brookes [2] demonstrated a close correlation, for the period 1896 to 1922, between the levels of the Victoria Nyanza and Lake Albert and the number of sunspots. It was perhaps the first, and one of the very few convincing, examples from the tropics of the periodicity of meteorological phenomena, which in this case fell neatly into the sunspot cycle of approximately eleven years. If only we could rely on that relationship the problems of the Lake Victoria project would be much simpler, but unfortunately we cannot. Brookes' correlation continued nicely until 1928, but the lake level should have been low again in 1932–33 and 1943–44; it was not. Dr. Hurst, who has recalculated the correlation for the whole period for which records exist, finds that the correlation co-efficient, which was as high as 0·83 for the period 1896–1922, has no significance since 1928, nor when the whole period since 1896 is considered as one. Although one might guess from the diagram that the relationship is now becoming re-established, all hydrological calculations about the the Lake Victoria project must be based on the assumption that no such relationship exists. Brigadier Hawes has calculated how the reservoir would have behaved if the outfall had, in fact, been controlled to provide a steady discharge during a period of rising lake levels (1904) and during a period of recession (1921). His results show that in neither case would the

[1] 1 milliard = 1000 million.

[2] Brookes, C. E. P., "Variations in the Central African lakes Victoria and Albert," *Geophys. Mem.* 2 (1923) 337–44.

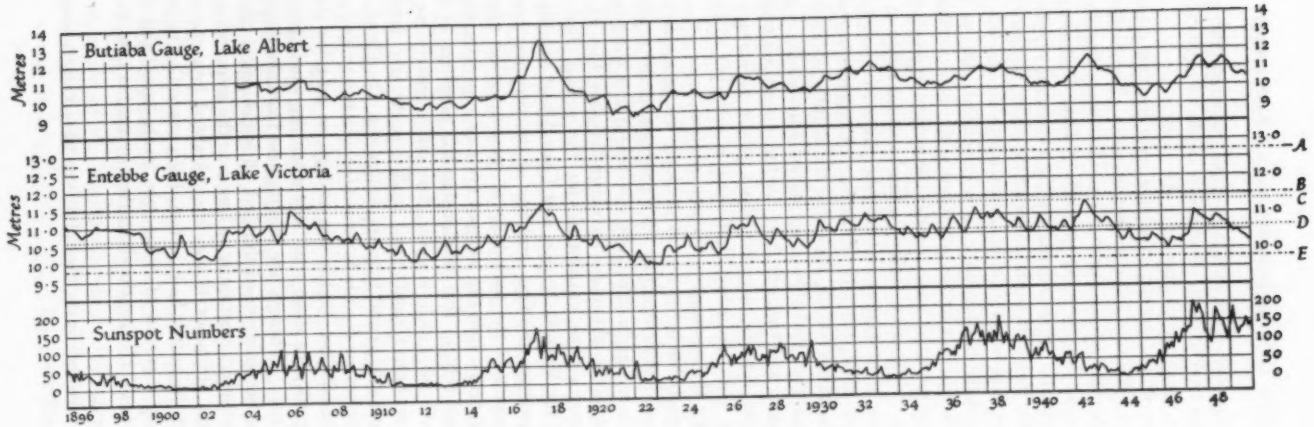


Fig. 2. Lake levels and sunspot numbers

controlled level have risen to the maximum which has now been agreed to by the parties concerned; on only one occasion (in the latter case) would it have reached the lowest level recorded.

Before leaving this subject we must note one result of the Lake Victoria project which will be sad for lovers of historic associations and natural beauty: the Ripon Falls will be drowned for ever. The engraved slab commemorating Speke's discovery of the source of the White Nile will no doubt be saved, but we shall never again be able to stand where he stood against the great rush of water and ourselves recapture something of that strange sense of great discovery.

The Nile in Uganda and the southern Sudan

The Owen Falls dam is only one of a number of major works on the White Nile affluents which are likely to be constructed during the next decade or so. Indeed the Lake Victoria project by itself would not be of much use without the others. All of them involve international cooperation and link East Africa to the north. Let us move down the Nile as far as Khartoum and glance at them.

The Owen Falls dam will drop the river about 60 feet below the level of Lake Victoria and the next reach of the Victoria Nile to Lake Kioga will, if later required, provide facilities for two further dams of the same height and the same hydro-electric output. Then the river broadens and to some extent loses itself in the great swampy area of Lake Kioga where a serious loss of water through evaporation and transpiration might occur unless there are arrangements at the downstream end of Lake Kioga to draw off the same amount of water as is let in from Lake Victoria. It is accordingly likely that Egypt may build a regulator in this area, probably on the rocky sill near the Atura ferry.

Thence the river wanders westward before plunging over the 150 foot drop of the Murchison Falls in that wonderful area of wild life which it is hoped will very soon become a national park. Here there is another enormous potential for hydro-electric power but, perhaps fortunately, this romantic spot is so far away from where the power might be used that very many years are likely to pass before it is developed. Twenty miles of navigable river bring us to Lake Albert which, at its south end, receives also the waters of Lake Edward, Mt. Ruwenzori and the Mfumbiro volcanoes, by way of the Semliki river.

Lake Albert is of very great importance in Nile control; it is here that Egypt intends to provide a further storage of water in order that it may be released on its two-month journey northwards to reach the Egyptian fields when it is most wanted, in the early months of the year when the Blue Nile is flowing at a minimum. The question cannot yet be regarded as settled; it is complicated by the need for preventing undue flooding in the Southern Sudan, and by the effect of the flash floods of the torrent rivers entering below Nimule. Of these torrents, the Aswa which drains a large part of Northern Uganda is the most important. It will be necessary either to find another site for impounding the torrents, somewhere between Nimule and Juba, or to arrange for the discharge from Lake Albert to be much reduced when they

are in flood. A detailed survey and examination of this question is proceeding at the moment.

Below the swampy reaches between Lake Albert and Nimule, there come the Fola rapids and an unnavigable reach to Juba before the valley opens out again into the great Sudd area. Here, under the natural regime, as much as half the White Nile water is lost by evaporation and transpiration; the average flow above the mouth of the Sobat being only a half of that at Juba, in spite of the extensive gathering grounds in the southern Sudan. To save a part of this enormous water loss there is the biggest project of all, the Jonglei cut or canal, which will leave the Bahr-el-Jebel at Jonglei and rejoin it at the mouth of the Sobat near Malakal. It will take about half the flow without any appreciable loss on the way, leaving the other half in the existing navigation course. Consequently three-quarters of the Nile's flow at Juba will reach Malakal, instead of half as at present.

This Jonglei project will be a huge development in itself, not only in the engineering and constructional work of making the canal, but in the effect it will have on the whole of the Sudd area, and its population. At present these vast plains, one of the few extensive areas of Africa which have too much rather than too little water, are peopled by unspoiled nomadic cattle men and fishermen, Nuer, Dinka and Shilluk. The cattle men depend in the dry season on grazing grounds near the water courses and hollows which are inundated for a large part of the year. The fishermen depend on the high fish productivity of flooded lands and the concentration of each year's crop of fish at bottle necks as the floods recede. The main effect of the Jonglei and Lake Albert projects together will be to reverse the flood seasons in the southern part of the area and to maintain the river at a permanent high level in the north. While this may provide opportunity for settled cultivation in certain areas, it will have a drastic effect on the natural grazing and on the fisheries. The Sudan Government is naturally much exercised in the many problems which are involved and has a Jonglei investigation team busily at work on them. This is indeed a unique geographical study which deserves a lecture to itself.[1] Moving farther downstream, the river soon comes under the influence of the Jebel Aulia dam which, when in full use, raises the river level as far upstream as Renk. And so to Khartoum, after which further control of the river downstream is complicated by the annual flash floods of the Blue Nile and Atbara. Other great control works are contemplated before the river is once again impounded by the Aswan dam.

Before leaving the subject of the Nile, and the important part which East Africa has to play, we should note a political fact basic to all considerations of the river, and that is the Nile Waters Agreement of 1929. This agreement took the form of an exchange of notes between Mahmoud Pasha, then Prime Minister of Egypt, and Lord Lloyd, the British High Commissioner in Cairo. It followed the report of the Nile Commission of 1925, composed of one member each from Egypt and the Sudan and a neutral chairman. The 1929 exchange of notes separated contentious political issues concerning the status of the Sudan from the economic question of the use of Nile water, and

[1] See J. W. Wright, *Geogr. J.* 114 (1949) 173–90.

acknowledged fully Egypt's natural and historical rights in the waters of the Nile and its requirements for agricultural extension.

In all this work on Nile control I would like to pay special tribute to Dr. H. E. Hurst, who might well claim to be the modern father of the Nile, so far at least as its hydrology is concerned. As Director-General of the Physical Department of Egypt for many years, and latterly as Scientific Consultant to the Egyptian Government, he has laid the foundations for the modern conception of Nile control. His seven volumes on the Nile basin and his 'Short Nile' provide of course the main reference works on the subject [1] and he has lately outlined the major projects in a lucid short article.[2]

I have digressed some way from the political confines of East Africa, but this has been with the definite purpose of showing that development in one part of Africa, such as Lake Victoria, cannot be considered as a thing in itself. The direct effects and the repercussions on other parts of the continent will be very great. We will now look southward and find implications of a different, but at the same time widespread kind, in another example.

The wild fauna and the animal industry

In the latter years of the last century the terrible animal disease rinderpest, which had come from Asia, swept southward through the continent of Africa. Decimating domestic cattle and the wild fauna alike, and aided greatly in its spread by the migrations or movements of infected herds of buffalo, wildebeest and antelope, the scourge reached East, West, Central and Southern Africa, where it did great damage to cattle industries. Since then great efforts have been made to control rinderpest, but in spite of the discoveries made in immunology and the many millions of doses of immunizing agents manufactured and inoculated into cattle, the disease continues to be enzootic and, in a large part of intertropical Africa, especially in Tanganyika, frequently breaks out in epizootic form. Although its southern frontier is now represented more or less by the central railway line in Tanganyika, the threat of reinfection persists in the countries to the south, where it could do far more damage now because the cattle industry of the Union of South Africa, the Rhodesias and Portuguese East Africa is much greater than it was in the 1890's. Rinderpest is in fact a problem which binds together the interests of most countries in Africa. This became clear at an International Rinderpest Conference held in Nairobi in the autumn of 1948, where it was generally agreed that the aim must be the eradication of the disease from the entire continent. A series of fronts must be established and held in succession, and mopping-up operations on a large scale must be conducted in the intermediate areas until the disease is eventually squeezed out of its last strongholds. One of these fronts must run from Lake Victoria to the Indian Ocean; another probably in the region of the southern boundary of the Sudan.

Rinderpest seems to depend to a large extent on the wild fauna; if there were no susceptible wild animals or if cattle and wild animals were segregated,

[1] Hurst, H. E., Phillips, P. and Black, R. P., 'The Nile basin,' 7 vols., Cairo, 1931–46; Hurst, H. E., 'A short account of the Nile basin,' Cairo, 1944.

[2] "Major irrigation projects on the Nile," *Civil Engineering and Public Works Rev.* September 1948.

it would be a relatively easy matter to deal with it. Rinderpest moreover is only one of the major diseases of which the distribution is conditioned or at least assisted by wild animals; other prominent examples are trypanosomiasis, various tick-borne diseases and foot and mouth disease. Most

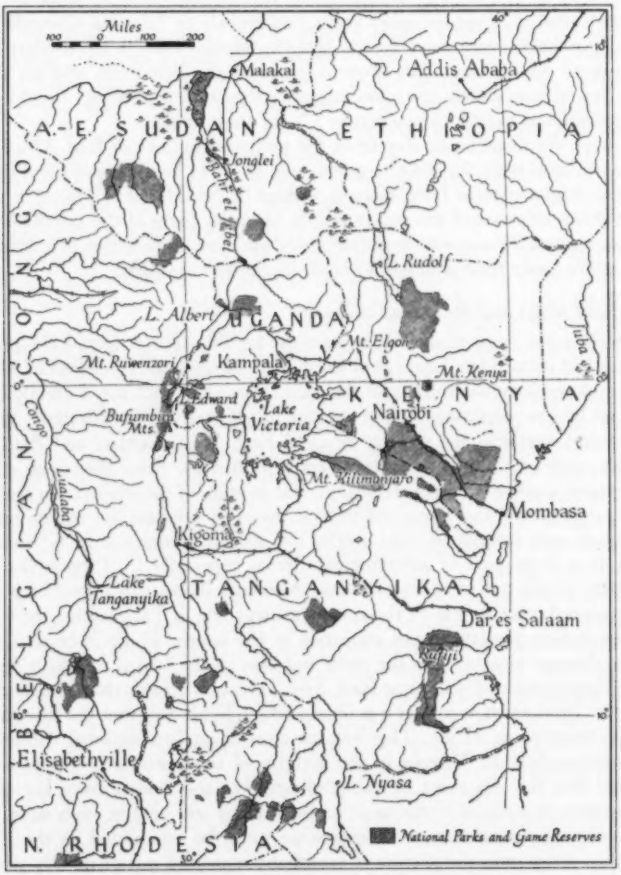


Fig. 3. National parks and game reserves

specialists therefore agree that these pests of tropical Africa will not be conquered until the contacts between wild and domestic animals are broken. The importance of overcoming them is of course beyond question, for they are the main factors limiting the development of the animal industry, especially in the drier or so-called marginal lands of Africa. In Tanganyika, for example, one must ultimately envisage very large areas of what is now

tsetse bush replaced by grazing. As compared with pea-nuts, cattle are more readily adaptable to the great deviations from the mean which are characteristic of tropical climates.

Contacts between wild and domestic animals have to be broken in face of the seasonal movements of both as they follow grazing and water supplies. In the past there have been strong differences of opinion on this question and some have gone so far to assert that the fauna must go. But there are few to-day who do not recognize that the unique inheritance of the African fauna must be conserved for all time, and hence we see the establishment of national parks as a geographical development of great importance. Ultimately we must foresee the wild fauna restricted to areas given over entirely to their welfare, and contact between them and cattle, or agricultural land outside, prevented by fences or barriers. The parks themselves will be managed by controlling the grazing and the wild animal populations dependent thereon, and by providing water supplies and the like in the sole interests of wild life. But before all this can come about, we must learn far more about the wild fauna, an important study which can be strongly commended to the new generation of scientists.

The things we require to know with precision are: what species of wild animals suffer from, or are carriers of, the main diseases of domestic animals? What areas of land do the different species require for their health and happiness? What are the movements and migrations of wild animals in the different areas; how can they be determined accurately (*e.g.* by the application of marking techniques) and how prevented? What are the best ways of ensuring that the population of wild animals in a prescribed area does not increase beyond the safety mark? Is it possible to arrange this by a correct balance between herbivores and predators without the intervention of periodic disease and heavy mortality? How can land, left mainly to nature, be managed in order to provide its maximum carrying capacity for wild life?

Enough has been said to indicate the great importance of wild life in modern conditions, and the field which is open for its study in East Africa. A similar field is open in the animal industry and a new stage of this study will, it is hoped, soon be inaugurated in a general survey of the diverse native breeds of cattle, their special characteristics, requirements and potentialities.

The inter-territorial scientific organization

The first conclusion from these and many other examples is that we are still beset by ignorance about the natural resources of East Africa and how best to use them. In consequence, decisions of far-reaching importance are sometimes taken on an insufficiency of knowledge and this must lead to a serious wastage of money and effort.

The scientific and research services of the East Africa High Commission, to which reference has already been made, are setting themselves the task of overcoming the back log of ignorance in as many subjects as possible. In the East African region there are, operating within the general orbit of Colonial research which is aided by United Kingdom funds, and in close touch with the technical departments of the Governments of the territories, a considerable number of departments and organizations actively at work, or in process

of formation. Some have existed for a good many years; others are new or incorporate pre-existing foundations. It may be useful to list them: The Agriculture and Forestry Research Organization (incorporating the former East African Agricultural Research Institute at Amani); the Veterinary Research Organization; the Tsetse and Trypanosomiasis Research and Reclamation Organization (incorporating the Tsetse research institute at Shinyanga and the Trypanosomiasis laboratory at Tinde); the Fisheries

Fig. 4. Headquarters and principal field stations of scientific services

Research Organization; the Lake Victoria Fisheries Service; the Desert Locust Survey; the Industrial Research Board; the Bureau of Medical Research and Hygiene (and various medical research units including the Virus Research Institute, Malaria unit and Health Survey); the Meteorological Department; the Statistical Department.

In addition to these, important branches of academic research on an East African basis are growing round the various departments of Makerere College where, among other things, a Sociological Research Institute is now being established. Research is also progressing in museums, particularly the

Coryndon Museum at Nairobi which is becoming a centre for the systematic study of plants and animals and also for archaeology.

In spite of the insufficiency of knowledge, a great deal is in fact already known about East Africa, through half a century of persistent if sometimes disjointed study by officials, missionaries, settlers and visitors. There are many specialist papers in scattered publications, many official reports, and many unpublished memoranda in departmental files; but by no means all of what is known is readily available to those who need it. During the development planning of Uganda, in common with others undertaking similar tasks, I found it necessary to compare a number of factors for different provinces and districts; physical and climatic features, vegetation and fauna, land use, population, *tsetse* flies, transport facilities, schools and hospitals, to mention just a few. The best, indeed the only, way of making such comparisons is with the aid of maps. With few exceptions, there were no maps of Uganda showing these factors in comparable form and so I had to assemble the information and sit down to draw sketch-maps myself before I could properly get to work.

Translating this simple experience to a wider sphere, it seems that there is a real need for assessing and summarizing what is known of Africa on a series of maps to a common scale; in other words, for a regional atlas of Africa. There are perhaps twenty main subjects which lend themselves to assessment on maps and in a number of cases arrangements are already in hand for the work to be done on an international basis; for example, the international geological map of Africa, and a map of *tsetse* fly distribution proposed at an international conference on the subject in 1948. In some areas work of this kind is already accomplished; there is an admirable atlas of Tanganyika on the scale of 1 : 4 million, and an atlas of French West Africa in more detail and on a larger scale is in active preparation by the Institut d'Afrique Noire at Dakar, under Monsieur Monod. This subject was discussed at the African Regional Scientific Conference at Johannesburg in October of last year and received wide approval. It is one which requires further thought as to the best ways and means, and one which may be commended to geographers. The preparation of a regional atlas of Africa involves the very essence of modern geography as I understand it; with the shape and structure of a continent as the basis, the complex of interacting factors must be analysed into its component parts, each part must be assessed and, finally, all the parts must be presented in their interrelated and interacting aspects as an organized whole.

This paper began at Godsiba Island, a place rarely visited even by the District Commissioner on his rounds. It has finished at the East Africa High Commission offices in Nairobi City, up four floors in an electric lift. But even in Nairobi you will still occasionally see the Kikuyu elder or the Masai *moran* in his native costume of red ochre and a blanket. Africa still has a resistance to development which, from the viewpoint of those who knew and loved the country many years ago, is sometimes good to see.

DISCUSSION

Afternoon Meeting, 22 May 1950

Before the paper the CHAIRMAN (Mr. L. BROOKS) said: By the generosity of Mrs. Will Gordon, this Society will be able to hear an annual or biennial lecture on East Africa. We regret that Mrs. Gordon cannot be present to-day, but we welcome her nephew. Recent geographical development in East Africa is a subject upon which Dr. E. B. Worthington speaks with authority. My qualifications for the honour and pleasure of taking the chair this afternoon are merely that I have visited East Africa and am very interested in the British territories there, especially in education. I am a member of the Special Committee that is concerned with the setting up of six Universities in the Colonial Empire, one of which will be at Kampala in Uganda.

Dr. Worthington is no stranger to our Society. He has been a member of the Council; he has already read three papers at meetings of the Society and has written several articles in the *Journal*. These papers and articles have been mainly concerned with East Africa and he now holds the office of Scientific Secretary to the East Africa High Commission. It is therefore eminently fitting that he should deliver this, the first Mrs. Will Gordon Lecture.

Dr. E. B. Worthington then read his paper.

The CHAIRMAN: We have had an extraordinarily interesting lecture and I am strongly tempted to say something about one or two of the subjects which the lecturer has dealt with, but there are several persons whom the meeting ought to hear and my first duty as Chairman is to call upon as many of them as time will permit. We are very glad to see Professor Debenham here this afternoon; he is just back from Africa.

Professor F. DEBENHAM: We have heard a very clear and interesting account of developments in East Africa. It is sometimes not unnatural to feel pharisaical, and I think this Society might feel pharisaical at this moment. I can think of no other learned Society which could have a lecture on such a broad field as Dr. Worthington has covered. You will also appreciate that only a man of wide scientific grasp could have given such a lecture and we are glad to have heard what he has to tell us about the development now in progress. It was the scientific side which he examined, but we must always ask ourselves what development itself is for. That brings in another aspect of research, social science research, a study which is now getting under way, perhaps a little more slowly than it might have done. New developments on the scientific side have gone ahead so fast that we have tended to forget the people who are to benefit by them.

Several of the developments described by Dr. Worthington were connected with water, and it is obvious that the distribution of water in Africa is unfortunate; some parts of the Continent having too much, so that swamps are created, while other parts have not enough. I think Dr. Worthington is wise in emphasizing the water developments, because in a sense they must come first.

The CHAIRMAN: We have with us also Mr. R. W. Steel of Oxford, to whom the Society often looks for help and advice in African affairs.

Mr. R. W. STEEL: I should like to join with Professor Debenham in thanking Dr. Worthington for this fascinating lecture—fascinating partly because of the subject, but fascinating also because he has focused our attention on some of the less well-known aspects of East African development. I think that many people might have assumed that groundnuts would have figured very largely in any talk on East African development to-day, but his only reference to

groundnuts was to 'peanuts' and had nothing really to do with the groundnut scheme.

The point is that there is a tremendous amount going on in East Africa about which the public, and the journalists and the politicians, are particularly badly informed and Dr. Worthington has introduced us to projects now being undertaken which will affect the well being not only of East Africa but many of the adjacent territories. Geographers owe a great debt to Dr. Worthington for what he has done on various occasions for the scientific study of Africa, and of East Africa in particular. Before the war he drew together all the details of scientific knowledge on Africa that were then available and published them in 1938 under the title 'Science in Africa,' as a kind of supplement to Lord Hailey's monumental African survey. Now he is acting in a co-ordinating capacity in East Africa, and by lectures of this sort, and in his published works, he is putting before us the activities which are going on at the present time in these territories. It is encouraging to know that a man of Dr. Worthington's influence and standing is so closely concerned with the new developments that must depend so much on their geographical background.

I was therefore particularly delighted to hear him plead for this international atlas of Africa and commend it to geographers. Some of us have been commending it to other people for some years, and they have not taken much notice. We like to think that Dr. Worthington with his influence and knowledge of the country will be able to go further. It is obvious that we want to have this knowledge in a form which is easy to comprehend, and until that is done there is always a danger that some of the schemes of development will go awry, because geographical and other facts have not been taken into consideration. We look forward to a sequel to this evening's paper, perhaps a second Mrs. Will Gordon Lecture, in which we shall learn something of the progress of the schemes about which Dr. Worthington has spoken.

The CHAIRMAN: And now we should like to hear Dr. Hurst, who is associated with the Ministry of Public Works in Egypt. You will recall that Dr. Worthington described him as the modern father of the Nile.

Dr. H. E. HURST: It was a pleasure to me to listen to Dr. Worthington's very interesting lecture, especially as I have been associated with him on some of the questions, or rather on one of the questions, about which he was talking; the question of Nile projects. I should like to support everything he said about the importance of collecting scientific data as a basis for these various development schemes, and perhaps I might say a little about the data on which these Nile projects were based.

Egypt was prevented from collecting data in the southern part of the Nile basin, before about 1900, by the Mahdi's occupation of the Sudan. A year or two after the battle of Omdurman the question of studying the Nile in the south for the benefit of Egypt was taken up, and from that time until now we have made reconnaissances and gradually increased the accuracy of our measurement of the quantity of water coming down, of the levels of the river, of the amount of rainfall, and so on. In no case have we had more information than we needed. We have always been short of some of the things we should have liked; and this in spite of the fact that we are, I think, now collecting several hundreds of flow measurements of the Nile and its tributaries every month, and observing river levels at about 150 stations.

The important thing is that, when you come to make schemes like the Lake Victoria reservoir and try to foresee the future, you must have a long series of records to go upon. In the case of Lake Victoria we have something like fifty years' records of levels, but even that does not cover all we want to know and

there is no guarantee that the next fifty years will be like the last. It would be necessary to examine the records over a very prolonged period to obtain all the results we want. Lacking such records for Lake Victoria, we began to study other rivers, the rainfall, and so on, but the longest records of the rainfall extend back only 150 or 200 years, and we had to look for other things. Long series of such records are provided by the rings of the big trees of California, and the annual layers of clay which have been carefully measured in some lake beds; these records go back for thousands of years.

As a result of analysing all these things we came to the conclusion that the old idea that thirty-five years provides a sufficient length of record for a river was not well founded, for the analysis showed bigger variations than one might expect on the ordinary theory of probability. That and the theory of what we called "century storage" was one of the most important things that came out of this research. We cannot have too much in the way of scientific observation on which to base such projects of development as Dr. Worthington has talked about. I should like to thank him for a very interesting account, and to commend his extraordinarily good photographs.

The CHAIRMAN: I will now ask Brigadier Hawes to speak; until recently he was the Chief Engineer of the Uganda Electricity Board.

Brigadier C. G. HAWES: A hydrological survey has already been started in Uganda, gauges and discharges are now being recorded on seventeen rivers and it is hoped to install a recording rain gauge on Godsiba Island. Five rain gauges of the container type, which has been used in Kenya Colony by the hydraulic engineer, have already been installed on islands near the north and east shores of the lake, but they have not given much in the way of results as the local fishermen have decided that the inner and outer containers form excellent buckets for household purposes.

Hydrological surveys are a vital necessity. The Lloyd Barrage works on the Indus in Sind (Pakistan) were designed on about forty-five years of river records, but in the twelve-year period between 1928 and 1940 the Indus discharge was found to be deficient for the requirements of the Barrage during the cold weather in seven of the years, which confirms Dr. Hurst's remark about records for thirty-five years being insufficient to cover all the variations in river discharge that may take place. It is essential that a central organization for East Africa should be set up in Nairobi for collecting and printing all hydrological data and, most important, for insuring that the collection of the data is done systematically in all the territories concerned, and in such a manner that it achieves a consistent degree of accuracy and that its acceptance by all concerned is assured.

The CHAIRMAN: We have with us Mr. Ford of the Geography Staff at the new University College in East Africa; I know that he has spent a lot of time in this region and we should like a few words from him.

Mr. FORD: It has been a great pleasure to see again on the screen some of the scenes with which I have been familiar, and next week I hope to be back among them. I have, during the last few years, been making a study of some aspects of Lake Victoria trade and I was very pleased to hear Dr. Worthington speak of the fishing industry, because that is one of the important aspects of my study on which at the moment there is very little accurate information. The effect of the fishery on the life of the population on the eastern and southern side of the lake is profound, and at times raises sociological problems. The Majita peninsula is in a state of severe soil erosion. It is over-populated and the administration are making all the efforts they can to resettle the people in the hinterland, and finding it very difficult to do so because the people are

loth to leave the shores where they can obtain cheap and nourishing fish. If one goes more deeply into the organization of the fishery one discovers that a very large and profitable trade is being carried on, in a not very well organized way, from the southern and south-eastern portion of the lake to feed the very dense population of the Kavirondo Gulf.

I should like to ask Dr. Worthington a question about the new dam. Egypt has, of course, a moral and historical right to the water. But has any reservation been made in view of future irrigation needs in East Africa itself? I am thinking particularly of the area to the south of the lake, where the provision of a water supply is one of the chief difficulties encountered in resettling the dense population of Usukumaland. If the water were available it would solve a serious problem in that part of Tanganyika.

The CHAIRMAN: Mr. Ford spoke of fishing in Lake Victoria, Dr. Hickling is the Fisheries Adviser to the Colonial Office.

Dr. C. F. HICKLING: We have heard a fascinating account to-night of developments in East Africa. I would remind you that the Secretary of State for the Colonies is sponsoring similar developments in all parts of the Empire and, if development is in some respects more advanced in East Africa than elsewhere, a large part of the credit must go to Dr. Worthington himself.

I had the pleasure of being on Lake Victoria last June and July and found the Fisheries Laboratory very well equipped. They are nearly up to establishment. Dr. Worthington mentioned that the number of fish caught per gill net in the Kavirondo Gulf had grown less and less. One reason may be that too many fish are being caught. But we are now going in for fish culture; and from fish cultural work it is known that rapid growth and a large size may be hereditary in fishes as in other animals. The staff on Lake Victoria now find that among the valuable *Tilapia esculenta* there are fish which breed at a small size. It may be that the decreasing catches by large-meshed gill nets are due to the progressive fishing out of the larger, fast growing fish, leaving the main burden of breeding to fish of poorer growth, which would not be caught. The scientific staff at Jinja are re-examining the whole question.

It is too late in the afternoon to say much more and I can only express my great appreciation, as a member of the staff of the Colonial Office, on hearing at first-hand from Dr. Worthington of the excellent work that is being done.

The CHAIRMAN: I am sure that Mr. Wright could tell us how the various Nile projects will affect the Sudan.

Mr. JOHN WRIGHT: I should like to say a word for the natives of the Sudan through which the Nile passes, the natives whom you saw in one or two of the pictures. One of our difficulties in the Sudan with this scheme is the change of life which these people are going to experience. Dr. Worthington spoke of the change of regime which the making of the canal and the dam have caused. It is obviously better, for agriculture, to have a river running at a steady level than fluctuating over an unknown range; yet it is these very fluctuations which make the present pastoral economy possible.

But let us imagine what it would be like if, let us say in the interests of the European Recovery programme and of general efficiency, we, as a seagoing nation accustomed to use small boats all round the coast and to visits to the coast for recreation at certain times of the year, discovered that the tides were stopped and found ourselves living on a sea whose level never changed. What would it be like to us, who have the sea in our blood? That is a point of view which deserves some consideration. I am not speaking officially for the Sudan Government in any way, but it is my job to find out what will happen to the

people who live there, and whose interests must not be forgotten when the needs of others farther down or higher up are being considered.

The CHAIRMAN: I think that Dr. Worthington has to reply to at least one question addressed to him.

Dr. WORTHINGTON: First of all I should like to thank Mrs. Gordon for the privilege of giving the first lecture in the series she has founded. There was only one major question addressed to me and that was about the possibility of Nile water being used for irrigation within East Africa, for example in the dry area near the south-east corner of Lake Victoria. The Germans prior to 1914 had worked out in detail a fair-sized irrigation scheme for the area, which could be fed by gravity from the lake as the watershed between it and Lake Eyassi is very low. The speaker asked whether any suggestion or provision had been made, during discussions about the Lake Victoria project, for using water from the Nile in that area. So far as I know, none at all. In these negotiations the Nile Waters Agreement of 1929 has been assumed to continue and this is of course legally binding. But I should, in that connection, like to quote a short passage from a very able book on international rivers by Professor A. J. Smith: "The purpose of law is to stabilize a particular position; the purpose of enlightened policy is to move forward to a better one."

The CHAIRMAN: All that remains is to thank Dr. Worthington again. We shall all read his paper with very great pleasure when it appears in the *Journal*. We have also to thank Mrs. Gordon, who I am sure will be pleased with the first of the lectures she has instituted.

THE FAILURE OF THE PHILOSOPHERS TO SAIL WITH COOK IN THE *RESOLUTION*

H. C. CAMERON

ON 15 JULY 1771 Captain Cook arrived in England on the completion of his voyage in the *Endeavour*, during which he had discovered the eastern coasts of Australia. On this voyage of circumnavigation, science was represented by the natural philosophers Joseph Banks (afterwards Sir Joseph Banks, Bt., and for forty-three years President of the Royal Society) [1] and Dr. Daniel Solander. Only four months later Cook was appointed to the *Resolution* with orders to proceed to the South Seas to clear up the controversy over the great unknown continent. Hastily Banks and Solander, determined again to accompany him, became immersed in preparations for the second voyage, and this time on a much larger scale. Banks's party was to number twelve, headed by Solander, Joseph Priestley, Zoffany the painter and Dr. James Lind, F.R.S., who had a high reputation in astronomy and geology. To accommodate so many, extensive alterations had to be carried out on the *Resolution*, which was a small ship, very low in the waist and, like the *Endeavour*, one of those stout, flat-bottomed colliers from Whitby on which Cook had learnt his seamanship and to which he always remained loyal. When the alterations had been completed it was found that they had made the ship quite unseaworthy; in Cook's words "so crank that she would not bear her proper sail to be set." The ship was therefore restored almost to her original condition. When Banks made his next and final inspection he wrote to the Admiralty that she was "neither roomy nor convenient enough for the purpose, nor no ways proper for the voyage."

To find that all his plans and hopes had come to nothing was bitter to Banks and he never forgave the Navy Board for its failure to see eye to eye with him. In his old age, as is well known, he wrote down [2] for his friend and librarian, Robert Brown, the story of his disappointment. There is however also in existence a copy of a long and passionate letter,[3] written in the heat of the moment, to Lord Sandwich, the First Lord of the Admiralty, which has been until now overlooked and which has never been published. In this letter he makes a last appeal that a larger ship should be provided and he even puts forward the regrettable suggestion that some other commander, less wedded to these uncomfortable little "cats" from Whitby, should supersede Cook. I have to acknowledge the gracious permission of His Majesty the King to make use of this material from the Royal Archives, Windsor Castle. Appended to the letter are the comments [4] of the Navy Board. Clearly the Board was concerned only with the task of fitting out what was

[1] Banks was founder and secretary of the African Association, founded in 1788 and merged with the Royal Geographical Society in 1831.

[2] Robert Brown Correspondence. Vol. 1. British Museum (Nat. Hist.).

[3] Roy. Arch. Windsor 1322.

[4] Roy. Arch. Windsor 1323.

to them a nautical expedition to be commanded by Captain Cook, the man who already had achieved so notable a success in the *Endeavour*. To the Board, Banks and the men of science were troublesome accessories whose convenience must not be consulted at the expense of other more important considerations.

In the Introduction to his official account of the *Resolution's* voyage Cook makes his own attitude very clear. Of the ship "proper for the voyage" he wrote [1]—"she must also be of a construction which will bear to take the ground and of a size which in case of necessity may be safely and conveniently laid on shore to repair any accidental damage or defects. These properties are not to be found in ships of war of forty guns, nor in frigates nor in East India Company's ships nor in large three-decked West India ships nor indeed in any other but North-Country built ships or such as are built for the coal trade which are peculiarly adapted for the purpose. It was upon these considerations that the *Endeavour* was chosen for the voyage. It was to these properties in her that those on board owed their preservation. . . ."

With the little colliers from Whitby, Cook knew that he could venture anywhere and in any weather and from this decision nothing would move him. Banks's outcry and opposition were of no avail from first to last. Lord Sandwich he might have persuaded but Cook would not give way. For once Banks's will did not prevail.

Yet despite many rumours at the time, Cook and Banks did not quarrel. That they did not is proved by their correspondence. The originals of three letters from Cook to Banks, written at different dates after the *Resolution* had sailed, are in the Mitchell Library at Sydney and are reproduced in facsimile in the first volume of the Historical Records of New South Wales. All are in a friendly tone. Copies of these three letters are among the Dawson Turner transcripts at the British Museum (Natural History). There is however among the transcripts a copy of a fourth letter which, so far as I am aware, has never been published, presumably because the original was lost at the time of the sale of Banks's papers and did not accompany the other three to Australia. Although unlike the others it is written in the third person, it too is not a letter likely to have passed between men who had quarrelled.

Mile End. Friday May 24th 1776

Captain Cook presents his compliments to Mr. Banks and thanks him for his kind congratulations and for the drawing of the New Zealand spruce; he will speak to Lord Sandwich to have it engraved and if his Lordship consents will be obliged to Mr. Banks for a description.

Captain Cook intends to be at the West End of the Town tomorrow morning and thinks he could spare a few hours to Mr. Dance [2] and will call upon him for that purpose about 11 or 12 o'clock. The stove which was in the *Resolution* was bought of Mr. Stephens in or near the Poultry, on the side of the street next the River. It was supplyed by the Navy Office and when the Cabbin

[1] 'The Second Voyage of Captain Cook' 1777. Vol. 1. Introduction xxv.

[2] The portrait by Sir Nathaniel Dance-Holland is now in Greenwich Hospital. A replica hangs in the Library of the Parliament of the Commonwealth. Dance later changed his name to Dance-Holland.

was reduced at Sheerness it was returned into the Store where probably it is now.[1]

These two men who had come through so many dangers together were to remain friends. If further evidence were needed it is forthcoming in the minutes of the small and select Royal Society Club. After the return of the *Resolution*, between her first and second voyages, Cook dined with the Club no less than eight times, sometimes as a guest of Banks and sometimes as a guest of Maskelyne, the Astronomer Royal.

MR. BANKS TO THE EARL OF SANDWICH, MAY 30TH 1772[2]

The present situation of Things regarding the proposed Expedition to the South Seas which it was my intention and inclination to have taken an active share in will I trust render any other Apology to your Lordship for this intrusion unnecessary.

To avoid the appearance of inconsistency and to justify my Conduct in the Eyes of the Public and your Lordship I feel it incumbent on me to state the reasons by which I am influenced to decline the Expedition.

When it was first proposed to me by your Lordship to go to the South Seas again if His Majesty should think it proper to send Ships to perfect the Discoveries that had been begun in the last voyage, I joyfully embrac'd a proposal of all others the best suited to my Disposition and Pursuits. I pledg'd myself then to your Lordship and have since by the whole tenor of my Conversation and Correspondence pledg'd myself to all Europe not only to go the Voyage but to take with me as many able Artists as the Income of my Fortune would allow me to pay; by whose means the learned World in general might reap as much benefit as possible from those Discoveries which my good Fortune or Industry might enable me to make.

The Navy Board was in consequence ordered to purchase two Ships, to fit them up in a proper manner for our reception that we might be enabled to exert our utmost Endeavours to serve the Public wheresoever the course of our Discoveries might induce us to proceed.

Two ships were accordingly purchased: but when I went down to see the principal Ship, I immediately gave it as my opinion that she was very improper for the voyage and went so far as to declare that if the alterations which I proposed would not be made I would not go in her.

In consequence of this the Surveyor of the Navy was sent to me with a Plan of the Ship; to him I stated my Proposals and laid down upon that Plan the quantity of room that I thought absolutely necessary to be allotted to me and my people for the carrying on our respective Employments.

When these alterations and those which were judg'd necessary also for the Accomodation of the Captain and the People were made, the Ship in falling down the River was found absolutely incapable of pursuing her intended Voyage.

The Navy Board have attributed this incapacity to the alterations that had been made and are of opinion that when the Ship is reduced to her original Situation, that in which I before refused her, she will be the fittest that can be had for answering the Nautical Purposes of the Expedition. Without suffering myself to controvert this Opinion of the Navy Board that the Ship will be very

[1] Dawson Turner Copies. British Museum (Nat. Hist.).
[2] Roy. Arch. Windsor 1322.

fit for Sea although many able Seamen concur with me in doubting it I must be allowed to say that the ship will thus be if not absolutely incapable at least exceedingly unfit for the intended Voyage.

We have pledg'd ourselves, my Lord, to your Lordship and this Nation to undertake what no Navigator before us has ever suggested to be practicable; we are to attempt at least to pass round the Globe through Seas of which we know no Circumstance but that of their being tempestuous in those very Latitudes in passing through which in Order to get round one Cape the whole Squadron commanded by Lord Anson narrowly escaped being destroyed. We have done more we have undertaken to approach as near the Southern Pole as we possibly can, and how near that may be no Man living can give the least guess.

In Expeditions of this nature the Health and Accomodation of the People are essential to success; when Sickness and discontent are once introduced it will be absolutely impossible to continue the Discovery; by the alterations made the Accomodations of the People are very much reduced for the Spar Deck being cut away 30 of the Crew are to be removed under the Gun Deck before sufficiently crowded, which being very low and confined without a free Air must infallibly in so long a Voyage produce putrid Distempers and Scurvy; and what my Lord ought more to be dreaded by a Discoverer than such a Calamity which must soon oblige him to quit his Discovery and very probably even put it out of his Power to bring Home any Account of what he has done previous to its fatal influence.

The Accomodations of the Ship are much lessened by the changes which have been made in the Equipment since the first Plan, the House of Commons have thought the Undertaking of so much importance as to vote the sum of £4000 to enable Dr. Lind to accompany us and assist us with his extensive Knowledge of Natural Philosophy and Mechanics the Board of Longitude have also engaged an Astronomer to proceed in each Ship and an extraordinary Establishment of Officers was thought necessary on account of the difficulties and Dangers which we were likely to experience in the Course of our Voyage.

Shall I then my Lord who have engaged to leave all that can make Life agreable in my own Country and throw on one side all the Pleasures to be reaped from three Years of the best of my Life merely to compass this undertaking pregnant enough with Dangers and difficulties in its own Nature, after having been promised every security and convenience that the art of man could contrive without which Promise no man in my situation would ever have undertaken the Voyage be sent off at last in a doubtful Ship with Accomodations rather worse than those which I at first absolutely refused and after spending above £5000 of my own Fortune in the Equipment upon the Credit of those Accomodations which I saw actually built for me? Will the Public be so ungenerous as to expect me to go out in a Ship in which my People have not the room necessary for performing the different Duties of their Proffessions a Ship apparently unhealthy and probably unsafe merely in conformity to the Official Opinion of the Navy Board who purchas'd her without ever consulting me and now in no degree consider the part which I have taken in the Voyage or the alterations which on my Remonstrance they concurr'd with me in thinking necessary, but now have taken away or should I embark could anything material be done by People under Circumstances so highly discouraging?

For my own part, my Lord, I am able and willing to put up with as small Accomodations as any man living can be content with Six Feet square is more than sufficient for all my personal conveniences, nor are any of my People desirous of a larger Allotment. 'Tis our great Cabbin which is too small and that is in reality the Shop where we are all to work which if not sufficiently

large will deprive the workmen of a possibility of following their respective employments and prevent me from reaping the Fruit earned by voluntarily exposing myself to danger and incurring a material Expence.

Neither personal hazard nor expence however will I withold when likely with their proper encouragement; born with an Attachment to a singular pursuit I have already performed two Voyages and in the course of them have merited I hope some share of the Public Regard, and though my services are upon this Occasion refused I shall always hold myself ready to go upon this or any undertaking of the same nature when ever I shall be furnished with proper Accomodations for myself and my People to exert their full Abilities.

To explore is my Wish but the Place to which I may be sent almost indifferent to me whether the Sources of the Nile or the South Pole are to be visited I am equally ready to embark in the undertaking whenever the Public will furnish me with the means of doing it properly but to undertake so expensive a pursuit without any prospect but Distress and disappointment is neither consistent with Prudence or Public Spirit.

As to the position of no other Ship being fit for the Voyage because no other could take the Ground [*i.e.* be beached] I cannot omit putting your Lordship in mind that within these few Weeks the *Emerald* one of our sharpest Frigates lay on shore on the Gunfleet a much longer time then the *Endeavour* did upon the Coast of New Holland after which she was got off. Sir John Lindsay also hawled up the *Stag* another of our Frigates at Trincomaly and shifted her Rudder-Irons during the course of his last Voyage What more, my Lord, did the *Endeavour* do or what more could any Ship have done in that particular point on which the opinion of the Navy Board so materially rests?

If these then are capable to taking the ground how much more so must the *Launceston*, [the] Ship for which we have petitioned your Lordship be as all seamen know that the bottoms of that class of Ships are flatter than any others employed in His Majesty's Service. For my own part I can only say that was your Lordship to think proper to let us have her for our intended Expedition, I would gladly embark on board a Ship in which safety and Accomodation both which must be consulted on a Voyage of this kind, are more nearly united than in any other kind of Ship I am acquainted with and well know that there are many Commanders in His Majesty's Service of undoubted Abilities and experience who would willingly undertake to proceed with her in the intended Expedition ambitious of showing the World that the success of such an undertaking depends more upon the Prudence and perseverance of the Commander than upon any particular Build of the Ship which may be employed.

I cannot conclude this Letter without thanking your Lordship for the many particular Favors which I have received at your Lordship's Hands in the commencement and during the prosecution of this my Favorite Undertaking of which I shall ever retain a most grateful sense. I do not doubt that was not your lordship prevented by forms of Office I should still continue to receive the same countenance and assistance and that if it should be thought proper to alter or enlarge the present Equipment your Lordship would still continue your Protection; as I am not concious that by any part of my Conduct I have forfieted that claim to it which your Lordships great condescension and goodness originally conferr'd upon me.

I am with the utmost respect
Your Lordships
Most obliged and most obedient humble servant
Jos. Banks.

May 30th 1772.

COMMENTS OF THE NAVY BOARD UPON MR. BANKS LETTER.[1]

Observations June 3rd 1772

Mr. Banks's first objection to the Ship respected only the Conveniences for himself and was then no more than this, that the forepart of the Cabin was an "Inch or two too low." As to the proper kind of Ship and her fitness and sufficiency for the Voyage, his opinion was never asked nor could have been asked with propriety, he being in no degree qualified to form a right Judgement in such a matter; and for the same reason his opinion now thereon is not to be attended to. As to what concerned himself as he increased his Suite, and his Demands, everything was done to satisfy him by which it happened that the Properties of the Ship were so much altered that it has been necessary to take away the additional works that had been done at his request; in doing which it was so contrived that the Difference occasioned thereby to him was simply this—the great Cabin (6 ft. 6 in. high between Plank and Plank) was shortened from 22 to 16 feet long; and there was one small Cabin for his Attendants taken away. After this small Reduction there remained on the whole much better Accommodations than he had in the former Voyage in the *Endeavour* and the great Cabin remained in Length and Height, though not in breadth, equal to those in a 74 gun Ship (*Bellona Superbe Arrogant* etc.) for an Admiral who frequently embarks in such Ships to command His Majesty's Fleet at Sea, whose Cabins are only 16 ft. 2 in. long and 6 ft. 6 in. high.

Mr. Banks seems throughout to consider the Ships as fitted out wholly for his use; the whole undertaking to depend on him and his People; and himself as the Director and Conductor of the whole; for which he is not qualified and if granted to him would have been the greatest Disgrace that could be put on His Majesty's Naval Officers.

His Assertion that the Ship is incommodious to the People and made worse to them by the late alteration has a very evil tendency to raise Discomfort amongst the People and for defeating the Voyage, but it may be averred he is mistaken in the Fact; for the People will be better accomodated, a freer Circulation of air throughout the Ship and in all respects [more] Wholesome and the men better lodged than they are in any Kings built Ship of the same Dimensions and Burthen.

The application of the Cases of the *Emerald* and *Stag* and the Conclusion he draws therefrom discovers him to have less knowledge of matters relating to ships than might be expected in one who has associated and conversed so much with His Majesty's Sea Officers. The First was on shore in a smooth-Water Channel at home, not in a distant, strange, desolate or savage Coast at the Antipodes. Six ships instantly anchored by her, hauled alongside her, took out her Guns, Provisions etc., and immediate assistance of every kind was sent from one of the King's Dockyards. The *Stag* if she was hove up or hove down at Trincomaly, it was a Port where there were all conveniences for fitting Ships of burthen and where undoubtedly they had all the like Convenience that could be had in the River Thames. Had either of these Ships been in the *Endeavour's* place on the coast of New Holland, they would never have been heard of again. Even if they had got off the Rocks, they could not have been hauled up to repair Damage, as was done by the *Endeavour*."

[1] Roy. Arch. Windsor 1323.

IRRIGATION AS A SOLUTION TO AGRARIAN PROBLEMS IN MODERN SPAIN

J. M. HOUSTON

SCARCITY OF ANNUAL rainfall is the main cause of poverty in Spain. One-third of the country, 182,000 square kilometres, has a mean annual rainfall between 300 and 500 millimetres and there are 35,000 square kilometres of steppe, 7 per cent. of the total area. Under such conditions the average labour return on cultivated land is small and fluctuations in crop production follow closely the high variability of precipitation. Poor returns and an unstable economy contribute to the poverty of the peasant farmer. It follows therefore that the fundamental object of Spanish national plans has been to raise the standard of living by overcoming the insufficiency of rainfall. Agrarian problems in Spain have thus an environmental background; they are emphasized by their political repercussions. These problems can be diagnosed geographically from two aspects; the monocultural nature of Spanish agriculture and, associated with it, an excess of rural population and a seasonal unemployment of labour. To estimate the value of irrigation projects in the development of the country, it is therefore desirable to consider their relevance to agrarian problems, their value in the existing economy, and the progress that has been made in irrigation schemes during the present century.

The dependence of Spanish agriculture on single crops

Because of the general aridity, 90 per cent. of the cultivated land is *secano*, suitable only for dry-farming, and on most of it, no matter what technical achievements are possible, the range of crops must remain strictly limited. To-day, only 12 per cent. of the *secano* carries a rotation of cereals and leguminous crops. The remainder is mostly under the system of *año y vez* (a cereal crop, followed by a fallow year).

The Mediterranean triad of wheat, olives and vines is the basis of Spanish agriculture. These are grown singly and their dependence upon a very unreliable rainfall in the greater part of the country accentuates the high instability of the agricultural economy. There is a close correlation between the wheat production of the *secano* and rainfall variability in the critical spring months, especially March in the south of Spain and April and May in the north. As irrigated wheat is of little importance, it is the *secano* crop that dominates the annual fluctuations. When the year's rainfall is low yields are low, and production falls below requirements;[1] prices are then high and the cultivator instinctively plants more wheat the following year. This will go on until there is an excellent harvest and overproduction. Such a climatic cycle occurred between 1929 and 1934 and was a major contributory factor to the unrest that preceded the Civil War. The index of bread prices means much more to the Castilian peasant than to the farmer of Western Europe, for his

[1] In pre-war years the average wheat yield was no more than 9 or 10 quintals per hectare.

standard of living is closely linked with this commodity and fluctuations in cereal production cause considerable economic and social unrest.[1]

The unfavourable environment accounts for the preponderance of cereals. Wheat represents an average 24·5 per cent., by value, of the total agricultural production and is the most important crop in twenty-seven of the provinces (see Fig. 1). This dependence on a single crop is greatest on the broad plains of Castile, for it is on the uniform Campos, Páramos and Tierras that cereal cropping is most marked. In the province of Valladolid, for example, 82 per cent. of the land is cultivated and of this 32 per cent. is under wheat. In value the cereal crop is however even more dominant.

In the south and north-east, olives are another monoculture. In Jaen, 46 per cent. of the cultivated area is under this crop, representing 54·5 per cent. of the total value of all crops. Some communes in this province have over 90 per cent. of the land under olives. Córdoba has 31·6 per cent., Seville 25·8 per cent. and Malaga 25·6 per cent. In the north-east, Tarragona has 25·6 per cent. and Lerida 22·1 per cent. Large estates and absentee landlords are a feature of oleiculture, and properties of over 90 hectares comprise 78 per cent. of the total area.[2]

Vines, a third monoculture, are the most important crop in five provinces of peripheral Spain, especially in Barcelona (where they cover 46 per cent. of the cultivated area), Tarragona (27 per cent.) and Valencia (27 per cent.). The importance of viticulture is however somewhat masked in central Spain where it is usually second to cereals; 14 per cent. in Ciudad Real and 13 per cent. in Madrid.

The other crops of peripheral Spain are much more diversified, although some of them are quite specialized. Thus Pontevedra has 51 per cent. of its cultivated area under maize, Coruña 20 per cent. under potatoes, Castellón 33 per cent. under citrus fruits and Almería 43 per cent. under esparto grass.[3] In these peripheral provinces however the instability of economy is not comparable with Castile and Andalusia. In the north and north-east, the heavier rainfall allows adequate rotations, the relief reduces the area of cultivated land and pasture dominates the agriculture. In the Levante the early developed irrigation systems allow specialization in export crops.

It is commonplace to contrast "pluviose" and "arid" Spain. There is the same contrast in the features of land use between central and peripheral Spain, with a much greater variety of crops in the peripheral regions compared with the Meseta, as is evident from the facts already given and from Fig. 3. In Central and Southern Spain major crises of agricultural production are related almost entirely to two crops, Castilian wheat and Andalusian oil, since the value of these is 31 per cent. of the total production. To illustrate the significance of these crops in the fluctuation of prices, statisticians of the Sindicato Vertical del Olivo have devised a "crisis coefficient"[4] (Fig. 2). In forming this index, the percentage values of wheat and olives in the total

[1] A useful study of this problem has been made by Martin Sanz, 'El Problema Triguero y el Nacional Sindicalismo,' Valladolid, 1937.

[2] Sindicato Vertical del Olivo, 'Estudios sobre la economía del aceite,' Madrid, 1944, p. 19.

[3] Sindicato Vertical del Olivo, 'El Paro Estacional Campesino,' Madrid, 1946, p. 25

[4] *Ibid.*

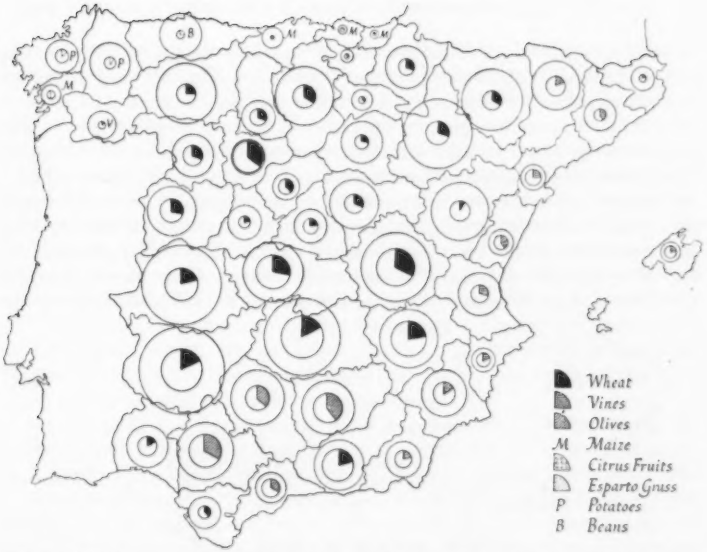


Fig 1. Chief crops: outer circles provincial area, inner circles cultivated area

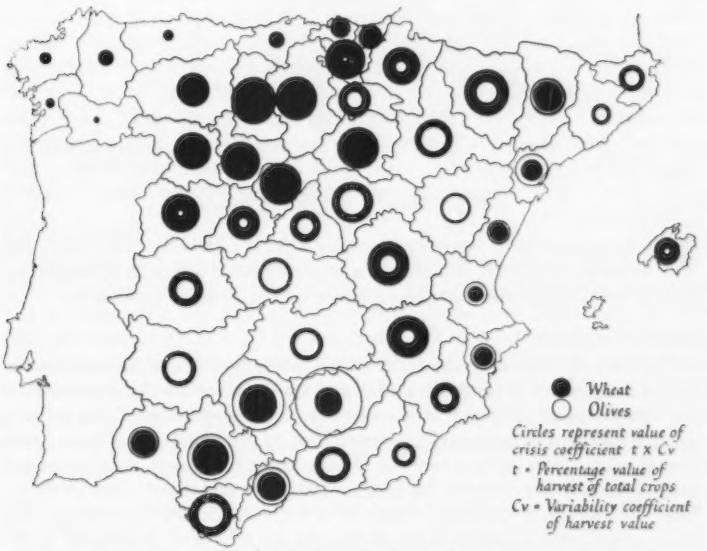

Wheat
Olives
Circles represent value of crisis coefficient t x Cv
t = Percentage value of harvest of total crops
Cv = Variability coefficient of harvest value

Fig. 2. Proportional "crisis coefficients" for wheat and olives

value of agricultural produce have been averaged for the period 1913 to 1935 and multiplied by their coefficients of variability. The factors determining the crises are bad harvests owing to irregular rainfall, low prices in seasons of overproduction, and the relative importance of the crop in each province. The features of the wheat problem have already been mentioned. In oleiculture the fluctuations of production are even greater. The olive is not a seasonal crop and trees take from ten to twelve years to reach commercial value. Moreover the oil yields fluctuate greatly; in the last thirty years, production has been six times higher in the best years than in the worst. Thus in the plains of the arid Meseta, in the wheatlands of the Castilian *campos*, in the vineyards of the east coast and La Mancha and in the olive groves of the Andalusian *campiña*,

Fig. 3. Areas of insufficient rainfall

dependence on these primary crops causes a great instability in the economy. The vagaries of rainfall dominate the fluctuations of annual production and it is clear that irrigation still plays a minor part in Spanish agriculture.

Rural unemployment

The second major agrarian problem in Spain is agricultural unemployment. There is an excess of rural population and this is one of the obvious causes of the low standard of living in the country. The proportion of the working population directly engaged in agriculture to the total population varies considerably, from 32 per cent. in Orense and 25 per cent. in Cuenca and Castellón, to 7 per cent. in the Basque provinces and 5 per cent. in Barcelona; in the latter provinces there is a large industrial population. The great agricultural densities of the north-west are related to *minifundia*, or the uneconomic sub-division of holdings. The highest rural unemployment is not

however found in the densely populated north-west but in the arid lands of the south, and is greatest in Jaen, with 20·8 per cent. of the national total, and in Badajoz with 16·4 per cent. (figures for 1942). Here unemployment is related to *latifundia*.

In addition to this recorded unemployment there is a very high seasonal unemployment, also greatly influenced by the dependence upon a single crop and the small use of agricultural machinery.[1] It is estimated that wheat uses only 50 per cent. of the potential annual labour, vines 61 per cent. and olives 67 per cent.[2] Harvest accentuates the seasonal fluctuation of labour and accounts for the great seasonal migrations of labourers. Gallegans come to the wheat lands of Old Castile, Andalusians and Extremeños to the vineyards of New Castile, Sorrianos and Serranos to the olive groves of Andalusia and labourers from north Alicante and Cuenca to the ricefields of Valencia. Seasonal unemployment means therefore a loss in potential production, a lower standard of living and general social unrest.

Before the Civil War, migration from the country to the towns was discouraged and by the law of *términos municipales*, the Socialist government prohibited agricultural labourers from migrating permanently from one municipality to another. The introduction of agricultural machinery was also checked.[3] It is now realized that it was a mistake to try to balance rural and urban population since the higher birthrate in rural districts implies a constant readjustment between the rural and urban populations. Since the beginning of this century the total population of Spain has increased by 33 per cent. to twenty-eight millions and, according to some estimates, a maximum population of thirty-three millions will be reached in 1967. The necessary increase in food supplies is to be provided by increased yields in the dry-farming areas and by the introduction of agricultural machinery, but the latter will itself reduce rural employment. An annual extension of 54,000 hectares of irrigated land will on the other hand provide increased rural employment as well as more food. Thus the expansion of irrigation and the associated plans for afforestation, road construction and colonization are an important contribution to the future of the country. Such is the claim: the history of irrigation between 1902 and 1948 does not encourage optimism.

The development of irrigation, 1902–48

The problem of surplus rural labour was first felt acutely at the end of the Spanish-American War in 1898, with the loss of the last remaining colonies and a consequent suspension of emigration. A solution was sought in the intensification of agriculture by irrigation. The first national plan of 1902 aimed to add 1·4 million hectares to the existing irrigated land, which then comprised 6 per cent. of the cultivated area and yielded 15 per cent. of the total value of crops grown.[4] The plan was of small worth because little was

[1] In 1948 there was one tractor to every 5000 hectares of cultivated land. 'Overseas economic survey: Spain,' H.M.S.O., 1949, p. 21.

[2] Sindicato Vertical del Olivo, 'El Paro Estacional Campesino,' Madrid, 1946, p. 25. See also Emilio Gomez Ayau, 'Indices para el estudio comparativo de explotaciones agricolas,' Madrid, 1946.

[3] E. H. G. Dobby, "Agrarian problems in Spain," *Geogr. Rev.*, 26 (1936) 186.

[4] *Congreso Nacional de Riegos*, 1913, p. 7.

known of the hydrological conditions. In 1915, a second and more modest plan was prepared, to irrigate one-quarter of the area previously suggested. The first World War and the Moroccan troubles so reduced the resources of the country that this plan too was never completed.

Until 1925, irrigation developments were sponsored privately. They were the cumulative efforts of past centuries and the cooperative achievements of groups of communes[1] and, especially along the Levante coast, the extension of irrigation was effected by the gradual coalescence of individual schemes. But full use of river water could not be effective without the control of the river basin and, after 1925, confederations were established in the principal basins (see folding map).[2] For such confederations to succeed the whole basin must be planned as one geographical unit so that problems of irrigation, flood control, afforestation and hydro-electric power development can be coordinated; and continuity of policy must be assured in view of the enormous commitments involved. None of these requirements has been met. Most of the plans have not been comprehensive but only hydraulic schemes for the construction of dams. The character of the confederations has changed three times between 1927 and 1939[3] and individual plans have changed also. It is however unfair to give the impression that no progress has been made. In Upper Aragon and Lerida in the Ebro basin, and in the Duero and Guadalquiver basins, there has been a development since 1902, though the fifty-year and the twenty-five-year plans have never succeeded as was intended.

Irrigated land is a general term and it is difficult to appreciate relative values from a map.[4] According to detailed statistics published in 1918, the area under irrigation was then made up as follows:

Canal, reservoir and lake irrigation	..	937,780 *hectares*
Well and other pumped irrigation	..	137,910 ,,
Spring-fed irrigation	..	239,268 ,,
Other supplies	..	51,483 ,,
Total		1,366,441 ,,

Just over a million hectares are now perennially irrigated and another half-million is seasonally irrigated.[5] The proportion of irrigated land to the total under cultivation varies widely, from 27 per cent. in Valencia to 0·3 per cent. in the steppe lands of Badajoz (see folding map). It is interesting to realize the high percentage of irrigated land in Alicante, although much of it is seasonal irrigation only and it is so scattered that it appears small on a map.

Irrigation projects have always been of two types; those to irrigate new land and those to change seasonal into perennial irrigation. The necessary hydraulic works are of two types also: diversion dams across the lower courses

[1] See M. Aymard, 'L'Irrigation du Midi de l'Espagne,' Paris, 1864.

[2] "The Irrigation System in Spain," *Internat. Rev. of Agriculture*, 19 (1928) 351.

[3] In addition to the plans of the confederations there have also been the more ambitious *trasvías* projects. See article in *The Times* of 29 August 1933.

[4] The folding maps incorporate data supplied by the *Ministerio de Hacienda*, 'Memoria sobre los Trabajos Realizados por . . . los Servicios de Catastro de la Riqueza Rustica y de Valoración Forestal,' Madrid, 1944–45. The irrigated area in 1900 is after J. Brunhes.

[5] In 1918, these figures were 917,091 and 448,750 hectares respectively.

AND DAMS, 1945

Area irrigated
Scheme under construction
Scheme under study
Dam constructed
Dam under construction
Watershed

RRIGATION BOARDS OF SPAIN

Confederación Hidrográfica del Ebro
" " *del Júcar*
" " *de la Segura*
" " *del Duero*
" " *del Guadalquivir*
Delegación de los Servicios Hidráulicos del Tajo
" " " " *del Guadiana*
" " " " *de los Pirenes Orientales*

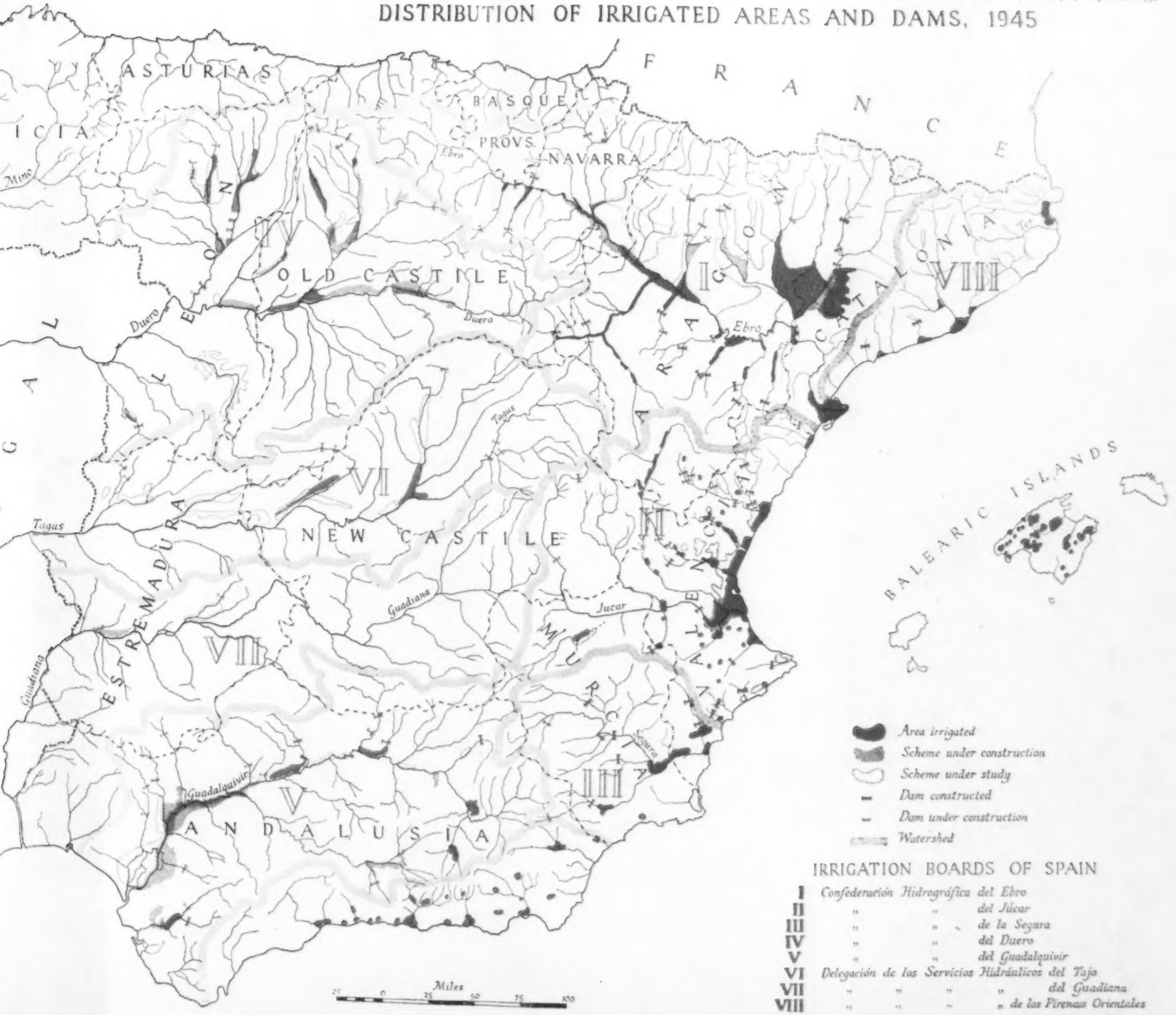
J. M. Houston

PERCENTAGE OF CULTIVATED LAND UNDER IRRIGATION, 1945

IRRIGATED AREAS, 1900

Published by the Royal Geographical Society

DISTRIBUTION OF IRRIGATED AREAS AND DAMS, 1945



IRRIGATION BOARDS OF SPAIN

I	Confederación Hidrográfica del Ebro
II	" " del Júcar
III	" " de la Segura
IV	" " del Duero
V	" " del Guadalquivir
VI	Delegación de los Servicios Hidráulicos del Tajo
VII	" " " " del Guadiana
VIII	" " " " de los Pirineos Orientales

J. M. Houston

of the rivers and storage dams in the upper basins. In the early developed *huertas* in the coastal plain between Catalonia and Valencia, only diversion dams were necessary. In the south-east some storage reservoirs were built from the fourteenth century onwards, but it has been difficult to maintain them. Modern development aims to control the flow of the rivers throughout their basins, bringing perennial irrigation to land that is now arid or suffers from seasonal drought.

The building of a dam is a long business; some begun before 1915 are still uncompleted, and dams under construction which may or may not fit into the present plan are an embarrassment. The technical problems of dam construction are also great, for the ill-distributed rainfall and the intricate mountain system of high *sierras* surrounded by level plains gives to the Spanish rivers a torrential régime. Sometimes a flood may be a thousand times greater than the normal flow[1] and, to secure permanency, dams must be built to a capacity far greater than the normal requirements. Further, the dams must be built in inaccessible country at the headstreams of the rivers.

The technical problems of dam construction are however less important now than the economic considerations. Works that will yield the highest return must be chosen and, as dams forming part of previous schemes are still under construction, this is not always possible. The plan of 1940 recognized four categories: works urgently required for immediate irrigation, those under construction, those not yet begun and those under study. The first category covers 103,537 hectares, principally in the basins of the Ebro (37,000 hectares), the Duero (28,364 hectares) and the Guadalquivir (28,143 hectares). Dams now under construction will eventually provide water for 159,000 hectares. An additional 757,300 hectares, especially in the Tagus and Guadiana basins, are included in the third and fourth categories. The total cost of the plan is estimated at about 1595 million pesetas, ranging from 826 pesetas per hectare in the first category to 1454 pesetas per hectare in the fourth.[2] The high cost of the last, and the present economic situation of the country, makes it uncertain if they will ever be executed.

The magnitude of the task of irrigation is apparent from these figures. Each storage dam costs an average of 50 to 100 million pesetas to construct and yet it is only a part of the scheme. Next follow the trunk canals, which often need aqueducts across the broad plains; there are over 267 kilometres of trunk canals in Upper Aragon alone, between the rivers Cinca and Gállego. In addition, there is the network of secondary canals. To bring the water to the site represents only 13 per cent. of the total expenditure; there remain the problems of colonization.[3]

The colonization of new zones has a propaganda value for the present government similar to that of the *beneficati* of the Italian Fascist régime. It enables the bigger problem of *latifundia* to be forgotten discreetly. The Instituto de Colonización, an executive body of the Ministry of Agriculture established in 1940, has already declared 375,199 hectares to be of national

[1] Valentín Masachs Alavdera, 'El Régimen de los Ríos Peninsulares,' Madrid, 1949.
[2] 'Plan General de Obras Hidraúlicas,' Madrid, 1940.
[3] Mariano Goméz González, "Colonización de las grandes zonas," *III Congreso Nacional de Riegos*, Valencia, 1921, p. 35.

interest, of which 45 per cent. is to be transformed by irrigation within the next few years. These schemes are outlined in the table below:

Zones of colonization in Spain, 1940–48 [1]

Date of plan	*New irrigation schemes*	*Area in hectares*
1940	Ebro basin .. .. (2 *zones*)	29,490
1945–47	Duero basin .. .. (5 „)	19,015
1946	Tagus basin .. .. (1 „)	10,051
1946	Guadiana basin .. .. (4 „)	73,200
1940–48	Guadalquivir basin .. .. (5 „)	36,928
	Total .. (17 „)	168,684
	Extension and improvement of existing zones	
1941	Ebro delta	30,000
1941	Salt marshes of Alicante	8,697
1941	Campo de Dalías	30,000
	Total	68,697
	Drainage of marshes	
1940	Marismas of the Guadalquivir	136,240
1946	Cantabrian littoral	1,578
	Total	137,818
	Grand total ..	375,199

To date, the most successful of these projects have been in Aragon where the mean annual rainfall may be scarcely 300 millimetres, and yet by irrigation population densities are being increased from 12 to 120 to the square kilometre.[2] With the advent of irrigation the labour requirements of such districts are increased many-fold. Of an estimated irrigable area of one and a half million hectares, only 100,000 hectares had been brought under irrigation between 1936 and 1948 and, by 1948, only 11,000 hectares had been reclaimed by the Instituto de Colonización. Even under the most favourable conditions it will therefore be many years before the Government target is reached. Yet if these experiments were an assurance of success, the two major problems of rural unemployment and economic instability would be mitigated.

Irrigation and crops

While the extension of irrigation will do much to increase the standard of living in the colonization zones, absorb surplus rural population and increase productivity, it will also introduce a new series of complicated economic problems. First there is a danger that, in the rapid development of irrigation over a short period, the existing markets will be swamped with produce which will ruin the old-established irrigated zones and eventually destroy the new zones as well. To create new markets is therefore a necessity, and to do this it is advisable for irrigation development to take place in stages. Equitable food distribution and an increased standard of living among the poorer classes of the towns would help to absorb increased agricultural production.

[1] Data from El Instituto de Colonización, Madrid, 1948.

[2] MS report of La Zona Violada, Instituto de Colonización, Zaragoza, 1948.

There is further the problem of the choice of crops for cultivation. It is generally uneconomic to grow wheat under irrigation because of the high costs; irrigated wheat occupies only 5·7 per cent. of the total area under wheat and accounts for only 10 per cent. of the total production.[1] There are also limits to growing rice. Before the shortage of artificial fertilizers, the yield was 70 quintals per hectare, the highest in the world, and prior to the Civil War the Spanish market suffered from overproduction. When the Marismas in the lower Guadalquivir are reclaimed, Spain will have three-quarters of her crop available for export. Sugar beet has expanded greatly in Old Castile and León but again further extension is limited. Present production costs are 350 to 400 per cent. above world prices and consequently there is neither an export market nor an expanding home market. In the Levante, there are limits to the orange crop since 75 to 80 per cent. is already exposed to the uncertain future of foreign markets; the use of new irrigated lands for this crop is highly speculative. Horticulture suggests another series of crops, but already the traditional *huertas* of the Levante and the south-east provide adequately for the demands of the home market. Crops with a much greater future in the new irrigation zones are those previously imported, such as cotton, maize, alfalfa and tobacco. To obtain the volume of cotton imported before 1936, it would be necessary to irrigate 150,000 hectares.[2] As however its profitable cultivation in competition with other summer crops, such as maize in the Andalusian campiña, depends on favourable world prices, it is not the most suitable crop for the best lands. Tobacco also has an uncertain future and cannot be grown extensively. Maize and alfalfa have the best prospects, as a greater emphasis must be placed on stock rearing in the new colonization zones. In all cases however the high cost of the irrigation schemes, apart from the problem of educating peasant cultivators accustomed only to dry-farming, makes the economic development of such crops problematical.

In assessing irrigation as a solution to Spanish agrarian problems, it is clear that it has only a limited value. Rural migration to the towns and the readjustment of urban and rural population which the Second Republic discouraged, the break-up of the *latifundia* estates which seems outside the present Falangist policy and the more intensive use of the *secano* lands are solutions whose claims are as important as those of irrigation. The last removes the physical liability of an uncertain rainfall, but it makes the irrigated region more sensitive to economic cycles and the choice of crops. The Spanish cultivator may be poor by reason of the aridity of the Meseta, but to plan irrigation development on too ambitious a scale may lead him from poverty to debt.

This article is based on a paper read to the British Association, Section E, at Newcastle in September 1949. I am grateful to Mr. J. N. L. Baker who read the original draft. I am also indebted to many informants in the Ministerio de Obras Públicas and the Ministerio de Agricultura, and to the Irrigation Boards of the Júcar and Ebro and the Instituto de Colonización for facilities to visit several of the irrigation schemes.

[1] Martín Sanz, *op. cit.*, p. 81.

[2] E. Martínez de Bujanda, "The Spanish national irrigation plan," *Internat. Inst. of Ag., Monthly Bull. of Economics and Sociology*, 25 (1934) 241.

URBAN HINTERLANDS IN ENGLAND AND WALES: AN ANALYSIS OF BUS SERVICES

F. H. W. GREEN

THE MAIN PURPOSE of this paper is to demonstrate the application of an objective method of determining the approximate boundaries of urban spheres of influence or hinterlands, for the conception of rural-urban communities of interest is not only of sociological significance in the scientific sense but of practical value in planning. The method, namely an analysis of country bus services, is of value not only in studying specific cases, but in providing a sufficient number of examples for some tentative statistical conclusions to be reached. A study of this kind moreover enables one to pose in tangible form questions which hitherto were perhaps not always easily defined. Hinterlands of peculiar shape or unexpected size, hinterlands in which the urban focus is eccentrically placed, boundaries which are very irregular, all call for explanation. No two cases will prove to be identical, but useful points of analogy will be found so that the history of change in one place may be used by town and country planners to forecast the probable results of developments proposed in another.

The work of defining the boundaries of the urban hinterlands described in this paper and of making the statistical analyses was not completed without the willing assistance of the staff in the Maps Office of the Ministry of Town and Country Planning, in particular of Mrs. K. M. Knight and Miss U. M. E. Rodd. Most of the detailed records, only summarized in this article, are available for inspection and study in the Ministry's Map Library and in the Regional Offices.[1]

The definition of urban centres

It is important to introduce at the start the conception of centres of different orders of significance. Five such orders are postulated.

First Order	Metropolitan Centre
Second Order	Provincial Centre
Third Order	Major Regional Centre
Fourth Order	Ordinary Regional Centre
Fifth Order	Service Village

London, as the metropolis of England and Wales, stands on its own as a centre of the First Order, having functions which are performed nowhere else in the country. At the other end of the scale are what are sometimes now described as "service villages," which provide facilities lacking in their immediate neighbours. Between the two extremes there is no clear-cut gradation, but three main types can be recognized; the Provincial Capital, exemplified by Birmingham or Bristol; the typical major regional centre or

[1] Mr. Green, formerly lecturer in Geography at University College, Southampton, is now Maps Officer at the Ministry of Town and Country Planning.

county town exemplified by Ipswich or Exeter; and theordinary small town with minimum urban functions. It is also clear that a town of any order performs, in a greater or less degree, the functions proper to lower orders as well. Certain specialized towns may have almost no Fourth Order function at all, serving a very wide area for a specific purpose only. Torquay and Bournemouth are examples.

The use of bus services in defining urban hinterlands

The analysis of country bus services affords a useful means of defining centres of the Fourth Order and delimiting their hinterlands. During the two inter-war decades services spread all over the country to such an extent that it is now difficult to find a hamlet of any size in England and Wales that is not on a bus route. The process was accompanied by intense competition and it is safe to assert that, in most areas, the most economic routes were discovered by a process of trial and error. The operators had in effect carried out an elaborate questionnaire to discover what was the potential demand. They had discovered where the majority of persons wished to make the majority of journeys. In the United Kingdom buses are also the cheapest form of public transport except where, in a few anomalous cases, the route taken by the road vehicle is necessarily so much more circuitous than that taken by another means of transport that the alternative means is cheaper as well as quicker. But it is quite easy to pick out the very few cases in England and Wales where this anomaly is significant. Barmouth in Merioneth is a good example; it is the railway bridge over the Mawddach estuary which brings the settlements of Arthog and Fairbourne into cheaper and quicker communication with Barmouth than with any other centre.

It is true, on the other hand, that in providing a new form of transport the bus services were creating a demand, and perhaps altering the natural spheres of influence of towns. It is possible, for example, that in areas of static or decreasing population the development of bus services encouraged the growth, relative or absolute, of major centres at the expense of minor ones. Be that as it may, a study of services existing in 1939 would have indicated not only what opportunities for travel existed, but also the extent to which they were utilized. An inspection of time-tables also shows that, in spite of the present shortage of vehicles, services in 1947 were generally speaking similar to those of 1939, though there had been some significant changes; duplicate buses were more frequently run, and double-deckers had often taken the place of single-deckers in areas showing an increase of population and daily movement. Winter time tables for 1947–48 were therefore used.

There are a number of points that must be taken into consideration if time-tables are to be used for defining the limits of urban hinterlands. It is essential that all stage carriage services are taken into account, and all express services, and special services (*e.g.* factory services) eliminated. Most of the larger companies issue time-tables, but many of the smaller operators do not do so, and it was therefore necessary to consult the Regional Traffic Commissioners, who were able to extract the approved timings for the latter class from their records of licences issued. Their ready cooperation greatly reduced the labour of the inquiry.

In many areas the full network of services is developed only on certain days in the week; services operating on Sunday only were, for fairly obvious reasons, neglected. Those operating on Saturdays only presented a problem, but experience in drawing the diagrams soon revealed that the Saturday services very rarely covered an area different from that defined by market day services. Eventually the method adopted was to plot market day services,

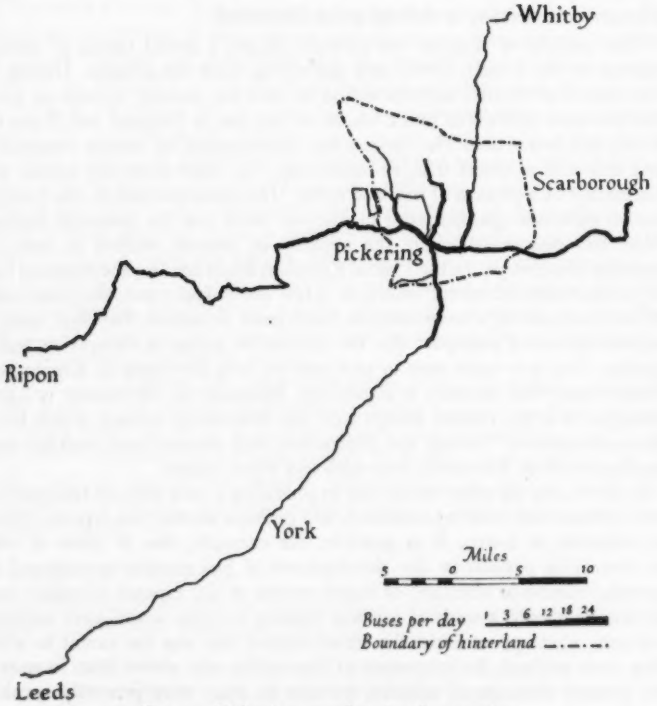


Fig. 1. Pickering: market day bus services

(see Fig. 1), and to add in a different symbol services which operated only on certain other specified days. But this refinement was in fact scarcely necessary.

Method and results of the analysis

Whereas a questionnaire automatically reveals which places the local population regards as centres, this is not the case with time-tables. For the purpose of the inquiry, towns were deemed to qualify as centres if there operated from them any bus services which served no places larger than themselves. With certain obvious limitations this proved a workable definition. It meant that if a place was served only by through routes (to and from larger towns) it did not appear as an "independent" centre. Provided there

was at least one local route, serving perhaps only a neighbouring village, the place could qualify as a centre.

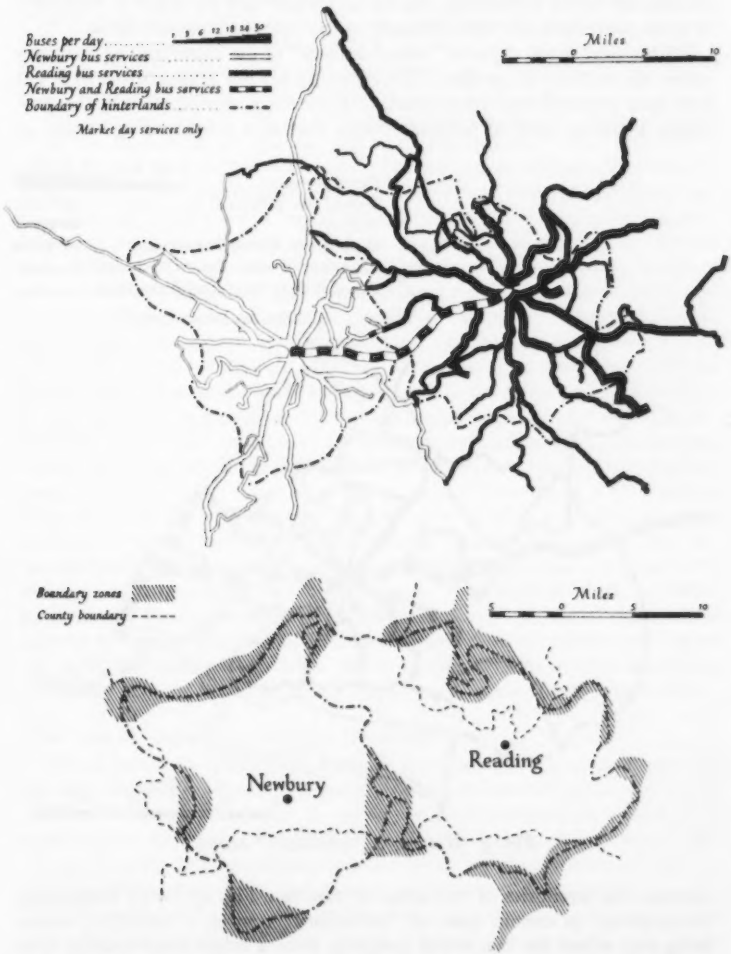


Fig. 2. Reading and Newbury: radiating bus-services and overlapping hinterlands

Having obtained records of all bus services, the method then consisted in drawing diagrams of the services radiating from each centre and superimposing them upon those of their neighbours. Figure 2 illustrates this in respect of Reading and Newbury, and the pecked line shows how the

boundary between the two towns was drawn. There can be little argument that this line does define the boundary between the area where the bus travel facilities are better to Reading, and the area where they are better to Newbury. In most cases there was little difficulty in drawing the boundary lines.

Efforts were made to avoid "island outliers" of the hinterland of one town within the territory of another. This difficulty did not arise as often as might have been expected and was averted, with one single exception, either by providing a narrow neck of territory within that of a neighbouring centre, or

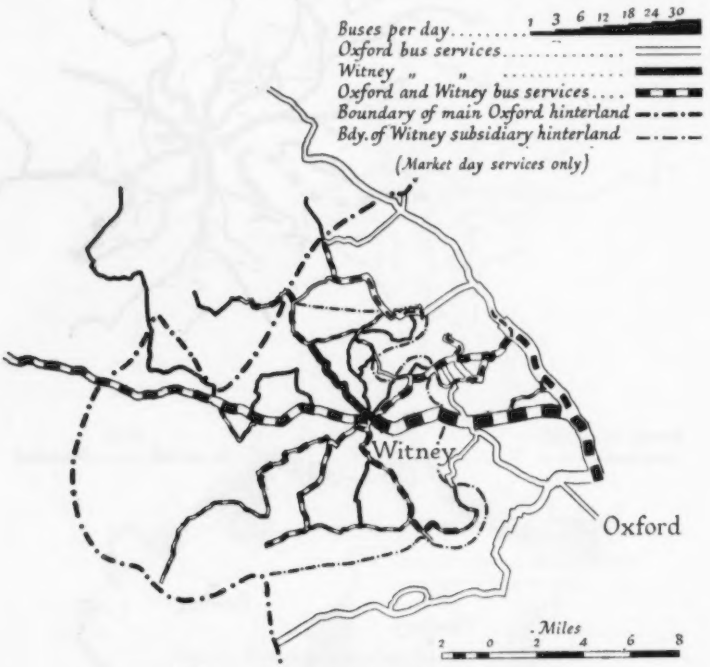

Buses per day..... 1 3 6 12 18 24 30
Oxford bus services.....
Witney " " .....
Oxford and Witney bus services....
Boundary of main Oxford hinterland
Bdy. of Witney subsidiary hinterland
(Market day services only)
Witney
Oxford
Miles
2 0 2 4 6 8

Fig. 3. Witney, a "subsidiary" centre

between the territories of two other centres (see Fig. 2); or by recognizing the existence in certain cases of "subsidiary" centres, a subsidiary centre being one where the bus routes radiating from a larger neighbouring town are so inter-digitated with its own as to indicate an area in which the two towns compete on about equal terms (see Fig. 3). About eighty such subsidiary centres were recognized.

The drawing of a single line as the boundary may be criticized on the grounds that hinterlands normally overlap. But on the analogy of watersheds, these boundaries may sometimes have sharp crestlines and sometimes resemble the Great Divide of the Canadian Prairie, both of which can be

represented by a single line. It would have been possible, as it is indeed desirable, to give some indication on the map of this kind of variation, but this would require a good deal more investigation. Even by the present method some idea of the sharpness of the divisions may be obtained. (Fig. 2.)

The folding map accompanying this paper shows the complete picture for England and Wales, and much of interest can be learned from a study of the areas and shapes of the hinterlands there portrayed.

The total number of centres, including subsidiary centres, which resulted from the application of this method was approximately 700. This agrees well with the total of 708 adduced by Smailes on an entirely different line of approach, based on facilities offered.[1] The lists of places qualifying by the two different criteria are however not coincident. In a number of sparsely inhabited rural areas places appear to function as Fourth Order centres though they do not possess what Smailes considers the minimum number of urban facilities. Allendale Town and Bellingham in Northumberland, and St. Columb Major in Cornwall, are examples. Conversely, a number of sizeable industrial towns and seaside resorts possess adequate facilities but command little or no allegiance over the surrounding countryside. Such for instance are Lyme Regis, Flint, and places like Eccles or Bacup in Lancashire. A comparison of the present map with a map constructed to show the distribution of cinemas throughout the country reveals that only twelve towns which qualify as bus centres are without provision for this form of entertainment; the majority of the twelve are in rural Wales. Such a high degree of correlation indicates the great significance which the cinema has now attained in rural as well as urban life. Access to cinemas must be taken into account in any kind of rural planning. Another comparison which has been made concerns provincial weekly newspapers. Here the factors are very complicated, and the degree of correlation is not so high, but it is of considerable interest to observe that the total number of towns where weekly newspapers are published is about the same as the number of bus centres (excluding subsidiary centres), and that about 75 per cent. are common to both lists.

The areas and populations of urban hinterlands

The areas of the hinterlands have all been measured and tabulated; the average, including subsidiary centres, works out at 81 square miles, the median being approximately 61 square miles. Estimates have also been made of the mid-1939 population of each urban centre and its hinterland. A map was prepared from these estimates, part of which is shown in Figure 4, and the table given on the next page is a summary of the compilation.

A few words of caution are necessary with respect to these figures. In the first place the functions of the centres themselves are varied, some being purely market towns, others primarily self-contained industrial towns in which the major part of the population is in occupations not directly connected with the economy of the immediate hinterland. Such towns are often made up of more than one administrative unit. Care must also be taken to include the right units to determine the total population of the centre itself

[1] A. E. Smailes, "The urban hierarchy in England and Wales," *Geography* 29 (1944) 41–51.

and in towns where much recent expansion has taken place there is commonly a sprawl of population into neighbouring rural districts. To avoid subjective error, the latter factor has not been taken into account. Again, since towns may have several functions in addition to that of being Fourth Order centres for the surrounding countryside, it is more suitable for many purposes of comparison to make use of the population estimates of the hinterlands alone. When this is done, we find that the average population for the latter is about 16,500 [1] and the median about 8500.[1]

Table—Distribution of hinterlands by area and population

Population (*thousands*)	*Areas in square miles* 0–25	25–50	50–100	100–200	200–400	*over* 400	*Totals*
0–5	65	56	34	16	4	—	175
5–10	30	35	52(1)	25	4	—	146(1)
10–20	12(2)	16(1)	30(1)	52(3)	16(6)	1	127(13)
20–50	9	9	24	35(8)	20(5)	5(5)	102(18)
50–100	—	5(3)	10(9)	13(7)	9(9)	3(6)	40(34)
100–200	—	2	5(7)	3	3(2)	2(4)	15(13)
over 200	—	—	—	2	2(2)	1(2)	5(4)
Totals ..	116(2)	123(4)	155(18)	146(18)	58(24)	12(17)	610(83)

(Figures in brackets indicate the number of subsidiary centres associated with the centres in each category.)

A survey made on an exactly similar basis for Northern Ireland [1] gives corresponding figures of 17,800 [2] as the average, and 9700 [2] as the median. In Denmark a survey,[3] also on a transport basis with bus services as the main criterion, produced figures of 17,300 and 14,200; this similarity is a fact of considerable sociological significance. A preliminary survey of Eire gives a rather strikingly different result, the average being 55,700 [1] and the median 27,000.[1] The implication is that the population of Eire uses the bus only for more significant journeys than in England, Wales, Northern Ireland and Denmark, and that there the bus centres are not necessarily Fourth Order centres. The matter would obviously repay further study.

Considering area and population together, we find that 60 towns had a population in the hinterland of over 50,000, and 70 towns served an area of over 200 square miles. In only 20 instances was both the hinterland population over 50,000 and the area served over 200 square miles. Five of these are remarkable in serving over 400 square miles. Ipswich and Exeter serve something over 50,000 people each, and Bristol and Norwich each serves over

[1] F. H. W. Green, "Town and country in Northern Ireland", *Geography* 34 (1949) 89–96.

[2] In all these statements, subsidiary centres are considered as though they were independent.

[3] H. Hinz, 'Oplandet og dets Behydning for Køpstaedernes Erhvervsliv,' Dansk Byplanslaboratorium, 1941.

100,000. The hinterland of Norwich is the largest in the country (over 600 square miles), which helps to justify the oft-remarked suggestion that Norwich has more provincial individuality than any other town in the country. The hinterland of Newcastle-on-Tyne exceeds 400 square miles by reason of its

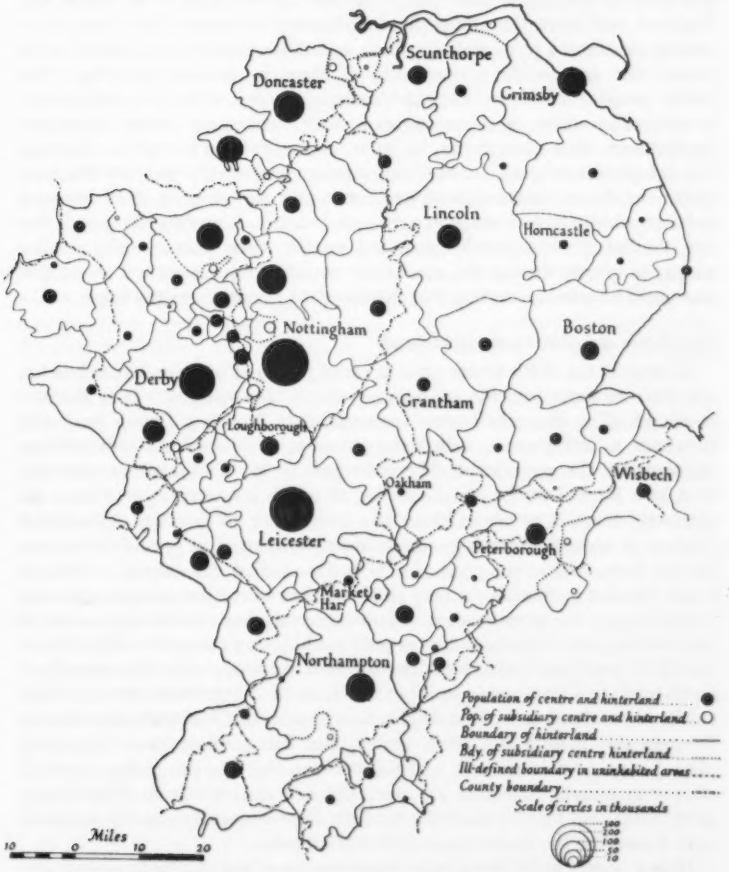


Fig. 4. Populations of towns and hinterlands; the North Midland Region

extension into Redesdale. At the other end of the scale there were 37 towns in which the total population served, town as well as hinterland, was less than 5000. Only 86 had an area of less than 20 square miles. Such an area is, of course, less than that of many large towns themselves. In only nine cases was both the population served less than 5000 and the area less than 20 square miles.

These densities must be particularly borne in mind when correlations are sought between populations in urban hinterlands and services provided (shops, cinemas, hospitals and the like). By studying a sufficiently large number of examples some useful generalizations may however be made. The numbers of the shops have been counted for the centres in south-west England, and from the tables thus constructed it appears that there is an average of about 110 persons (in town and hinterland) for each shop in the centre; the average for a town alone is about 60 persons per shop. This matter needs much closer study and analysis, but it is at least a quick pointer to anomalies which need investigation, and it can have certain immediate applications. One example may be given. A certain town in southern England which had suffered considerable bomb damage sought a Compulsory Purchase Order for the reconstruction of its central area and claimed what appeared to be an unduly large acreage as a shopping centre. It was readily shown that the number of sites thereby provided would, when added to the existing shops, so greatly exceed the admittedly tentative figures quoted above that one could be safe in asserting that the shopping precinct was too large.

Population structure in the hinterlands

Centres of the Fifth Order present many points of interest, but this is not the place to enter into the controversy about "key villages." It is however worth recalling the relationship between what Professor Stamp has, with reference to rural areas, called the primary, secondary and adventitious elements in the population. My colleague S. W. E. Vince has observed that, in a Rural District the population of which is known to be almost exclusively devoted to agriculture, the proportion of primary agricultural workers to secondary workers (those mainly employed in providing services for the former) is in the ratio of 2 to 1. He studied Marshland, a Fenland Rural District in Norfolk; it may be found that where the agriculture is of a different type the proportion is a little different, but the divergence is not likely to be great. The secondary population in such a rural area will be found mainly in nucleated villages in Anglo-Saxon England, or in the specialized hamlets of the Celtic west—in other words in the Fifth Order centres. Difficulties arise where, as in East Anglia, many places are doubtfully classified as between the Fourth and Fifth Order; and bus services have themselves played some part in the rise and fall between the two categories. But it is clear that certain functions are normally not carried out in Fifth Order settlements, and that for them the rural dwellers frequently travel (commonly once a week) to the nearest accessible market town.

If, in a purely agricultural area, our estimates of population in centres and hinterlands are correct we should, by studying instances which are not too complex, be able to obtain an idea of the ratio between the urban, mainly secondary, population and the rural population within which, as we have seen, the ratio is about 2 to 1. Several small towns in eastern England may be said to have very few families who are not associated with agriculture, and Wisbech may be taken as a typical example. Here, and in such characteristic market towns in purely rural areas as Horncastle (Lincolnshire), Launceston (Cornwall), Ledbury (Herefordshire), Northallerton (Yorkshire), Kirkby

Stephen (Westmorland), Market Weighton (East Riding), or Llanidloes or Ruthin in Wales, the population ratio between town and hinterland is found to be fairly constant at 3 to 5. Since one-third of the hinterland population is assumed to be secondary, the ratio between secondary and primary in the town and hinterland together emerges as $[3+(^1{}_3\times 5)] : [(^2{}_3\times 5)]$; *i.e.* 7 to 5.

In spite of the perverseness of administrative boundaries and the existence of subsidiary, moribund or growing centres within the hinterlands themselves, with the consequent difficulty of estimating populations, divergences from these ratios are a valuable guide in the study of rural facilities. If for example the ratio of town population to hinterland population is much lower than 3 to 5, it must mean one of four things; agriculture is either more backward, less mechanized, less intensive, or of such a nature that marketing is less complicated than normal; or the town is deficient in urban facilities; or there is an unusually high proportion of secondary population in villages or hamlets within the hinterland; or there is an excess of adventitious population in the hinterland and not in the town itself (which is unlikely). These are questions which those engaged in rural planning must attempt to answer. One may mention a few towns without attempting to explain the low ratio they exhibit; Holsworthy (ratio 1 to 4 instead of 3 to 5), Lampeter (1 to 9), Llangefni (1 to 3), Leyburn (1 to 4).

If on the other hand a town in a mainly agricultural area has a comparatively large population in comparison with its hinterland, it may mean that it has either Third Order functions as well as Fourth Order, or that it has a large adventitious population. It is probable that the latter is usually the main reason. It is indeed not easy to find a Third Order town without a considerable adventitious population; Boston (Lincs.) and Bury St. Edmunds are probably as good examples as can be found, and examination shows that the ratio of population in the town to that in its Fourth Order hinterland is here only slightly greater than three to five. This would suggest that the Third Order function does not always involve a much larger secondary population than does the Fourth Order. Many parts of the country are indeed without direct access by bus, or easy acces by any means of transport, to a Third Order centre; presumably the local residents save up for infrequent visits to the Second Order town, the Provincial Capital, or even to London. The study of the hinterlands of these major cities is however beyond the scope of the present inquiry.

In modern England and in much of modern Wales the great majority of Third Order towns, and probably even the majority of Fourth Order towns, have an adventitious population (industrial, commercial, administrative or retired) and discrepancies from the three to five ratio are in the main due to this. Occasionally one finds a fortuitous three to five ratio hiding a similar proportion of adventitious population in the town and in its hinterland. Such is certainly the case with such strange bed-fellows as Neath and Ystalyfera in Glamorgan, and Tunbridge Wells, Barnsley and Haywards Heath.

Different types of urban hinterland

The fact that hinterlands overlap need not worry us greatly if we remember the conception of a low or high watershed. An average hinterland is however

made up of many components. Every single commercial, industrial, professional and administrative undertaking has a territory of its own, and these territories cannot exactly coincide. To take an average of the boundaries between different types of hinterland would involve assessing subjectively the amount of significance to attach to each; hence the merit of tackling the problem indirectly, by studying transport facilities provided and used. Nevertheless it is apparent that in some urban hinterlands the average is a mean between almost coincident individual functional hinterlands, whereas in others there is so much difference that the average is of somewhat reduced value. It is therefore important to consider significant types of functional hinterland. Hinterlands defined by the daily journey to work and by retail shopping and distribution are perhaps the two most significant, and it can

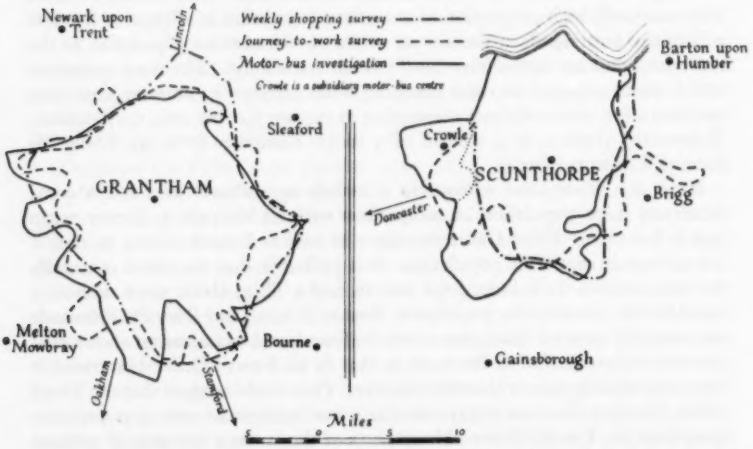


Fig. 5. Grantham and Scunthorpe: "watershed" lines for different functions

indeed be argued that all others tend eventually to conform to them. It may further be argued that the journey-to-work hinterland ultimately reveals itself as the dominant factor.

In the North Midland Region, surveys, organized by the Regional Office of the Ministry of Town and Country Planning, have been made of these two types of functional hinterland. Both surveys are imperfect; the journey-to-work survey was by means of a questionnaire sent to employers of more than twenty insured workers and not all of these replied; the shopping survey was a village-to-village questionnaire. But there is no reason to suppose that there is any great inaccuracy in the general picture. Fig. 5 shows for Grantham and Scunthorpe the "watershed" lines of (*a*) the Journey-to-Work Survey, (*b*) the Weekly Shopping Survey, and (*c*) the "average" hinterland obtained by the present method of study. One would conclude, and rightly, that Grantham and its surrounding territory have a well-integrated community of interest. At Scunthorpe, on the other hand, the journey-to-work

and shopping hinterlands are not coincident to the same degree. The bus service hinterland derived from market day services does coincide more closely with the weekly shopping hinterland, but it may well be expected that the better daily services to Scunthorpe (by train as well as road) will lead to the shopping "watershed" of the latter extending eastwards as the journey-to-work has done. Corby in Northamptonshire well illustrates the tendency for a newly developed work centre to become also a shopping and entertainment centre, and the decision to apply the New Towns legislation here will, one hopes, lead to better planning than would otherwise have been the case.

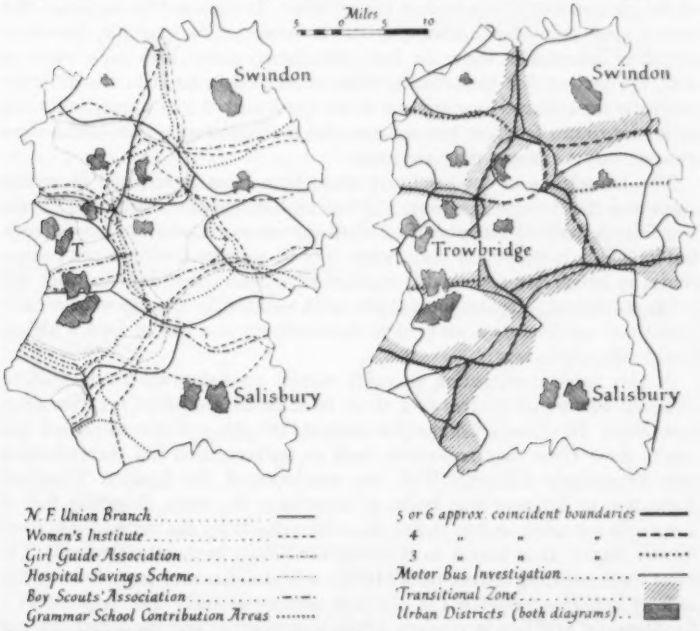


Fig. 6. Wiltshire; the general coincidence of areas of voluntary associations and of bus service hinterlands

If one examines twenty towns in the North Midland region which emerged as centres in the shopping survey but which failed to qualify as bus centres, one finds that fourteen of them "exported" more workers daily than they "imported." There is every reason to suppose therefore that, if recent tendencies continue, they will go on losing ground as shopping centres. Of the six exceptions, Sandiacre, Kirkby-in-Ashfield, and Beeston are part of the South Nottinghamshire industrial area and either directly adjoin, or are virtually part of, larger urban centres. There remain three, Caistor, Immingham and Raunds, each of which is worthy of closer examination for there must be, or must recently have been, a growth of population here. Is it still continuing?

A fairly detailed survey of functional hinterlands is to be found in Bracey's survey of Wiltshire.[1] In that county of nucleated villages it was relatively easy to conduct a reliable survey by questionnaire. In a comparison between the results of the present investigation and the answers to his question concerning weekly shopping the agreement is good. Figure 6 summarizes the results of a survey of the boundaries of six voluntary county associations and the approximate coincidence of the areas so defined and the bus hinterlands. Except near the county boundary which, in these activities, imposes an obligatory limit it will again be seen that the comparison with the boundaries of the hinterlands of bus centres is very close. It must not be supposed that such a close coincidence always exists; in Somerset, for example, the corresponding boundaries show far less coincidence either with each other or with the bus service hinterlands. This is certainly related to the difficulty evidently experienced by operators in the south-east of that county in finding economic routes for their bus services; for their successive time-tables show more frequent changes than are usual.

The boundaries of food delivery areas have been ascertained in certain cases and the divergences from the bus hinterlands are of interest. In the new 'North Staffordshire plan' Eccleshall appears as a centre for food delivery, but its failure to qualify as a bus centre is to be correlated with its not being a centre to which any appreciable number of persons travel daily to work and it has no cinema. Regular journeys to work account for the extent of Stone's hinterland northwards of its present food delivery area and of Leek's hinterland to the south-west.

A very large conurbation presents certain special problems in that its different functional centres and their hinterlands are often very far from coincident. In Greater London for example the places where men work and where their wives shop and where both go for recreation and entertainment may be entirely different. With the assistance of the London Transport Executive an attempt was made to determine the main shopping foci of London's suburbia, and to define their hinterlands by the method described in this paper. It is hoped to describe the results in detail elsewhere. The most distinguishing feature of life in the suburbs of a very large town is this lack of cohesion between the different aspects of daily life. It presents a fundamental problem in modern urban communities and the internal social structure of conurbations merits much further attention.

Where a change is taking place and the direction of change is not frequently altering, it would seem that the different types of functional hinterland tend to coincide. To revert to the "watershed" analogy, there are however certain areas of stagnation which may be likened to areas of inland drainage. These are small hinterlands which, according to the criterion adopted, either just appear or just fail to appear on a map. If it were possible to obtain sufficient data to construct it, a three-dimensional model would illustrate this, and other points, exceedingly well. Failing such a model, a series of sections could be used instead. An imaginary section drawn along a line between Norwich and Bury St. Edmunds might resemble Figure 7. The most dominant place is Norwich, a city which is a major centre for so

[1] H. E. Bracey, 'Wiltshire: rural realities,' Methuen (in the press).

many different functions that it may, to preserve the physical analogy, be said to represent a low base-level which enables its converging transport services to cut back into its neighbours' territory. By most counts, Wymondham has been "engulfed"; its catchment area is represented but as a step on the road leading into Norwich. Attleborough, farther away, appears by some criteria as an area of independent drainage; by other counts it has been

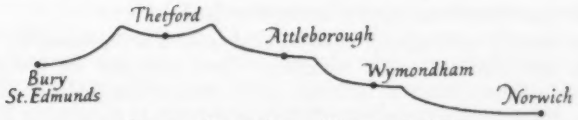


Fig. 7. An analogy of "watersheds"

engulfed by Norwich. Thetford retains independence, with a catchment area of some 110 square miles lying between those of Norwich and of Bury St. Edmunds. The latter has not such a large tributary area as Norwich, but is nearer to Thetford and probably therefore the more dangerous competitor. One may say here that the one "gradient" is steeper than the other.

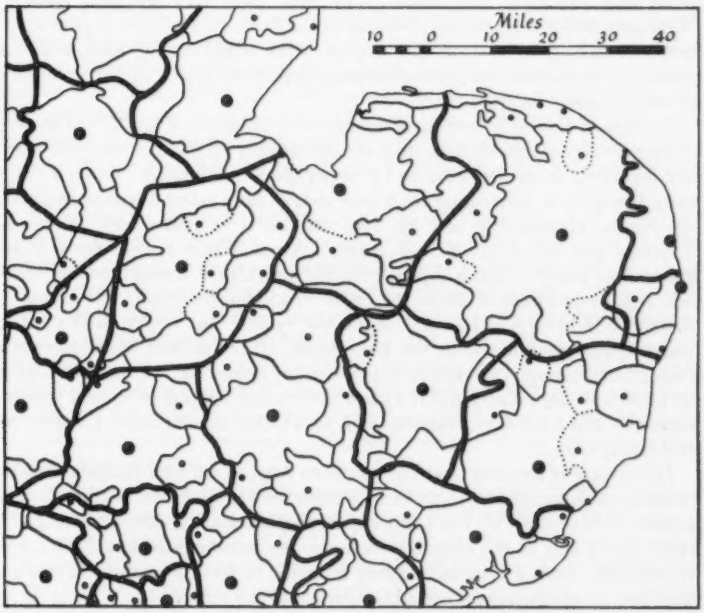


Fig. 8. Hinterlands of Third Order centres

Implicit in these remarks is the conception of centres of different orders of significance. Norwich and Bury St. Edmunds are towns with a Third Order

function; Thetford is not. Norwich is perhaps the most important Third Order town in the country which does not qualify for the additional function of Provincial Capital. It is possible to map, by methods similar to those here employed, the approximate hinterlands of Third Order towns as such, if one accepts Smailes' definition of minor cities and major towns in identifying the centres. A portion of the map so constructed is shown in Figure 8.

Physical factors affecting types of urban hinterland

The most obvious type of topographical control is illustrated by a more or less self-contained valley hinterland. Good examples are provided by Machynlleth and Llanidloes in Wales, and by Alston (Cumberland), Allendale Town, Rothbury and Bellingham (Northumberland), in the north of England. The last two illustrate another point of interest in that a valley which is a through route may appear to lack a centre; for Rothbury and Bellingham, serving the valleys of the Coquet and the North Tyne, qualify as centres while no centre is revealed in Redesdale, a valley lying between them. Redesdale appears to be a prolongation of Newcastle's hinterland. One may fairly safely assert that this is related to the fact that Redesdale carries the main road traffic from Newcastle to Edinburgh across Carter Bar. It is not likely that the local agricultural community pays very frequent visits to Newcastle but it is likely that, because of the facilities available, it pays more frequent visits there than the population of the neighbouring dales, and that there is in Redesdale a larger non-farming population which has a community of interest along the main road.

In lowland England there are of course many instances of lines of old market centres along valleys, though they are not usually so distinct since they are not separated from one another by unpopulated watersheds. Other factors come into play in delineating the hinterlands of such valley towns as Bedford, St. Neots, Huntingdon and St. Ives on the river Ouse, and Warwick, Stratford and Evesham on Shakespeare's Avon. Where a river flows in an entrenched valley which is topographically difficult for through communication it has taken little to divert the traffic in another direction. For example, though Whitby serves Lower Eskdale the middle and upper parts of that valley appear to fall within the hinterlands of Loftus and Middlesbrough respectively, though each lies outside the valley altogether. Often a town with an unusually large hinterland is a route centre at a meeting of several valleys. Salisbury and Exeter are examples and, on a rather smaller scale, Launceston and Monmouth.

Dorchester is situated near the southern edge of its own hinterland with comparatively gentle slopes down to it from the valleys to the north, whereas a mile or two south of the town comes the upstanding east–west ridge of chalk which acts as the boundary between the territories of Dorchester and Weymouth. Such a coincidence may however be fortuitous for, more often than not, an escarpment is not a boundary between hinterlands. One looks at the map almost in vain for any indication of the lines of the Cretaceous and Jurassic escarpments which cross South England and the Midlands. The usual historical explanation is that market towns commonly grew up at boundaries between areas engaged in different types of farming, serving as

meeting points between farmers whose common interest was the exchange of produce.

The indented coastline of England and Wales provides yet another type of physical control, commonly though not always exercised indirectly. The small average size, and irregular shape, of the hinterlands in Cornwall is due in part to the indented peninsular character of the county. But, apart from seaport towns which like Bristol and Hull have long since developed into centres of more than local significance, the hinterlands of coastal towns tend to be smaller than the average. The most obvious reason is that only about half as much territory can lie within the same radial distance from the centre. In medieval times seaport towns were frequently situated as far as possible up-river; not merely for shelter, but because such a site is central to a more extensive hinterland than one at the river mouth. This is perhaps rather more revealing than merely to state that the lowest bridging point of a river or estuary commonly coincides with the highest navigable point. Exeter and Ipswich are two characteristic examples. Some seaside towns are very specialized and, as with mining towns, the physical factor acts indirectly.

Economic and social factors

Hinterlands of small area characteristically occur in densely populated industrial districts, but each district has characteristics of its own. In South Wales topographical units coincide in general with social and industrial areas and cause the valley hinterlands to be sharply defined. In the upland parts of the West Riding there are several hinterlands (*e.g.* of Sheffield and Barnsley) where the dominant factors are seen to be topographical in the west and social and industrial in the east. In the West Riding generally, and in Lancashire, a close analysis of the effects of the various factors would be well repaid.

An interesting point is well illustrated in the Black Country, where six centres have been identified. Two, Dudley and West Bromwich, in the "industrial core," have almost exclusively urban hinterlands. Around them lie, in order of importance, Birmingham, Wolverhampton, Walsall and Stourbridge, three of which reveal very clearly the tendency of rural hinterlands to be developed eccentrically on the side opposite to the nearest conurbation. In Lancashire and Yorkshire this tendency can be seen not only in the small centres immediately around the Manchester–Salford conurbation, but also in the larger towns just outside the whole industrial area; the large hinterland of York, for example, being less extensive to the south-west than in any other direction.

County Durham is a complex area in which a considerable lack of coherence is evinced. Spennymoor is an extreme example which illustrates the tendency. The area of greatest lack of unity of outlook in this county is that near Easington which has been selected as the site of the New Town of Peterlee. This draws attention to a point of general interest, examples of which can be seen all over the map. Some hinterlands are a neatly shaped approach to the theoretical hexagon of the honeycomb, whereas in others straight line boundaries alternate with irregular inter-digitating lines. It must not be supposed that these latter are an entirely accurate representation of the

irregular boundaries of the neighbouring hinterlands, but they are of some significance and indicate that in such a border area there is competition between one town and another. Where three or four hinterlands meet under such confused conditions one might well say that there is a *prima facie* case for a New Town. For example, a New Town sited near Charing or Lenham in Kent, where the hinterlands of Canterbury, Maidstone, Faversham and Ashford converge, could reasonably be planned as a focal point for a group of persons who have now no ties with any one particular town.

The community of interest focusing on a line of communication has already been illustrated by the Newcastle–Edinburgh road and examples may be seen around London. The line of the Great North Road can be detected in the elongated hinterland of Hatfield, and to some extent at Hitchin. The partial severance of the hinterland of Leighton Buzzard is seen to be due to the influence of the Holyhead road, which has created a community of interest of its own; the influence of the Folkestone road can be seen in the alignment of the hinterlands of Wrotham and Swanley Junction, two places which qualify as centres only by reason of local bus routes running along this road. The "streakiness" of several hinterlands to the south-west of the metropolis can be related to the lines of roads across the heath country, and also to the railways. Here towns such as Woking have sprung up around railway stations, as dormitories for London workers.

Hinterlands whose orientation, and even existence, is due to railway communications are revealed by the survey, which stresses the fact that in general bus services reflect tendencies already initiated by other forms of transport. Thus the eastward extension of the hinterland of Romford (part of the undifferentiated hinterland of the London conurbation) was due to facilities early provided by the electrified District Railway. This is faithfully reflected in the local bus network.

Industry is not confined to the great industrial areas; there are a number of industrial towns of various ages set down in rural England which have carved out hinterlands for themselves. Eastleigh (Hants) where the L.S.W.R. set up its main railway works in the middle of the last century qualifies as a small but growing centre. A reverse tendency can be seen in some of the little industrial towns of earlier ages. Higham Ferrers, Burton Latimer and Rothwell in central Northamptonshire are, by contrast with neighbouring Corby, no longer centres; Desborough qualifies by little more than an academic margin. In several parts of the country small medieval wool towns no longer function as centres. On the other hand Swindon, which until the nineteenth century was a very small market town, has now become a railway and general engineering centre; it has increased its hinterland greatly, at the expense of its neighbours including Marlborough, and has engulfed several smaller areas such as Wooton Bassett and Highworth.

Mineral extraction often leads directly to industrial development and thus to the growth of a town, as can be seen for example in South Wales, Lancashire, Yorkshire and County Durham. The growth and decay of towns can sometimes be traced as mining activities shift from exposed to concealed coalfields. In the latter, new centres can be seen developing at the present day. Thus Dinnington, which has no urban history, appears as a

subsidiary centre at the eastern extremity of the Sheffield hinterland and Bolsover, a little farther south, now qualifies as an independent centre.

A geological control acting through the social history of mining communities is illustrated by the two very unusually shaped hinterlands of Ammanford in South Wales and Spennymoor in County Durham. The Ammanford hinterland extends in a long arm down the Gwendraeth valley between the hinterlands of Carmarthen and Llanelly. This can only be explained by the tendency of residents in the old anthracite collieries in the valley to maintain a common interest with the "anthracitopolis" of Ammanford. Spennymoor is the only case where the hinterland had to be shown on the map in two parts, the main one round the town itself and the other near the coast, completely surrounded by an area in which Sunderland holds the major interest, and separated also by a territory primarily tributary to Durham city. The explanation would seem to be a community of interest between mining families in the newer colliery area near the coast and their connections in the older area near Spennymoor. Coal mining is not the only activity which has led to this result. Ironworks set up where the ore is extracted afford a good example, as in the village which within the last twenty years has grown into the town of Corby (Northants). Corby has already carved itself out a hinterland from the territories of Stamford and Kettering.

DISCUSSION

Afternoon Meeting, 5 December 1949

Before the paper the CHAIRMAN (Mr. E. W. Gilbert) said: In recent years British and foreign geographers have made many attempts to measure the accessibility of country to town, and in the course of this work efforts have also been made to delimit precisely the territory that is functionally dependent on any one town. In these studies Mr. Green has played a prominent part. After a careful and very elaborate study of all the bus services of England and Wales he has divided the whole country into areas which he calls the "hinterlands" or "spheres of influence" of towns. In previous papers Mr. Green has discussed these divisions for small parts of the country only. To-day we are to see the complete map. Before the war Mr. Green was a University lecturer in geography. He is now a research officer in the Ministry of Town and Country Planning. There is no need for me to say more by way of introduction, and I now call upon him to read his paper.

Mr. Green then read his paper.

The CHAIRMAN: We have listened to a most interesting lecture, and I now call upon Professor Holford, Professor of Town Planning in the University of London, to open the discussion.

Professor W. G. HOLFORD: All who are concerned with the placing, the growth, or the preservation of activities in town and country—as I have been in recent years—must have been seeking some reliable basis of judgment. Questions difficult to answer crowd upon one and the difficulty is, I think, in inverse proportion to the arbitrariness of one's powers. In the eighteenth century the landlord consulted, in many cases, his pocket and his fancy, but the modern planning authority, if it is anything at all, has to achieve its object by resolution of an enormous number of different forces, many of which seem

to me to change direction even while the development plan is being prepared. The point Mr. Green has been investigating is an illustration of two of the advantages of which a planning authority or department of State, if it has the sense, is able to avail itself. First, the services of a whole range of people who have been trained to think about fundamental problems of urban and regional geography, of land economics and town planning, of social administration and so on. Secondly, the building up of standards or techniques perfected by the work of people coming afterwards. They are measuring rods which show sparsity or congestion or other anomalies in the location and distribution of these activities.

The Town and Country Planning Act, 1947, set up a vast regulatory system. Fortunately for the peace of this meeting we are not called upon to discuss compensation, but the requirement, now universal, of permission for the erection or change in use of any building has a direct bearing upon what Mr. Green has been saying. Even at the most detailed level, as when one is considering such matters as the merging of two shops into one, the division of a house into flats, or the putting up of a workshop, garage or bus shelter, some quantitative basis of assessment is continually needed. It is not only the appearance of what has been designed; one needs to feel that one can place the building, or whatever it may be, in some proper relationship to past and future needs. One asks: Is this necessary and, if so how many of them, and how many have there been before? How much space is needed and how can it best be distributed? How much more is this necessary in such major decisions as the use of a large rural estate for housing, or the location of a new town? Mr. Green's paper seems to me to provide valuable answers to these questions, and I am grateful to the Royal Geographical Society for allowing me to come here this evening to say so.

I know from past experience (and I am sure Dr. Willatts, Mr. Beaver and many others whom I see here would support me) that it is easy to fill one's time in an office by delving deeper and deeper into fascinating problems which have less and less application to the functions of the department for which one is working, and I am afraid it is even possible for the administrator to abandon the ferret to his hole and to walk away in disgust, confirmed in his conviction that the experts are impossible people to work with. It seems to me that studies of the kind we have heard described this evening do choose a nice mean between those two extremes; yet I feel sure they have been fascinating to Mr. Green. Such studies can and will be used by those of us who have to apply this science to particular problems of planning and administration.

The field is very complex; the time that must be needed to collect all those bus time-tables, to consult local people, and then to draw up the results, must have been prodigious, and I am sure that much credit is due to the Maps Office of the Department.

From Mr. Green's maps and the tables we were able at Cambridge—which is one of the towns in which I am engaged in preparing a plan for the County Planning Authority—to envisage the size of the population of the hinterland served by the borough, which we found extremely useful in deciding the kind of information we required. We had to make proposals for traffic improvements and bus routes, the amount of additional shopping space required in the centre, the position of the central bus station in relation to roads and car parks, and the floor space for residential and non-residential purposes that would be likely to be needed during the next twenty years. We found the information useful in determining what questions we had to ask, but when we came to ask them we found, as did Mr. Green, that we were involved in a mass of additional

facts before we could really decide the answers. We had to find out the bus journeys and routes, the number of passengers carried and the number of changes; we had to survey the floor space from house to house, investigate the rate of growth of population and ascertain the local traders' estimates of demand.

To sum up this method of applied science in the realm of town planning, I would say that, from this small experiment and the application of Mr. Green's theories, I come to these conclusions: the system of bus services in a region does, I think, reveal where the majority of persons wish to make the majority of journeys and, as bus transport is usually the cheapest and most convenient form of public transport, its hinterland is the first and most significant sphere of influence that a planner can use for the purpose of analysis. I was much impressed by the integrity of the investigation; it seems to me that Mr. Green has established his technique and has set up a standard, and for that I feel sure all planners will be grateful.

But standards, like sharp knives, are as dangerous as they are useful; I sometimes think that their danger and their uses are proportionate. They are valuable in skilled hands but have a habit of producing standards instead of selective variation—which to me is the real science of planning. It seems to me therefore that the best results can follow from the determination of spheres of influence by the study of bus services, in two particular ways: first, by showing the essential differences between one region and another rather than by suggesting conformity; secondly, in saving those who apply these techniques an enormous amount of time and worry by giving them a measuring rod which tells them what information is really essential for their purposes. And having been taken so far by Mr. Green, one cannot resist asking him to take us a little farther and tell us how most quickly to correlate the bus hinterland with other essential hinterlands one must find out about in planning, the journey to work, to the shop and so on; he showed us one or two interesting examples in Grantham and Scunthorpe.

Finally, one small point. Do not some bus services compete much more severely than others with private cars and with bicycles and must not one make some allowance in a number of these hinterlands for those two features? For example, at Cambridge we have more than 40,000 bicycles for a population of 86,000 in the borough. I notice that the use of bus services fluctuates remarkably with the season and weather; on wet days the buses are crowded. That is only a small instance, but for private cars we were unable to calculate even approximately how much parking space the central shopping areas would need as between the inhabitants of the borough and the inhabitants of the hinterland. Lack of parking space may reduce the number of customers from the hinterland, but shopping by car tends to extend the hinterland itself. Many other factors must also affect the final picture.

These comments are made only from the planning point of view. I would hazard a guess that, as a contribution to human geography, Mr. Green's study will stand in its own right as a creative piece of work which I hope will lead to other studies being undertaken. I am glad to have had the opportunity to say how much I have learned from his paper.

Professor E. G. R. TAYLOR: It falls to me, first, to thank Mr. Green for his paper which has given rise to so many points for discussion that I shall have to discard some of those on which I wished to touch. Unfortunately, Mr. Green did not include the part of his paper which contained the more controversial matter, namely, the application of the map. But he is a civil servant and the first and last rule of life in the Civil Service is: Don't be awkward! Some

of the applications suggested by the map might be awkward! And not only the civil servant but all administrative persons shun the awkward.

Comparison suggests itself with the technique adopted by Mr. Smailes in delineating "urban fields" as enunciated by Dr. Dickinson. In his bus service technique Mr. Green has the advantage of the Maps Department staff and Miss So-and-So does the work. That is what we university people did not have when I was there. Mr. Smailes used as criteria such particular facilities as banks, chain stores and so forth. It is clear that the bus companies worked out the hinterlands worth covering by a system of trial and error, and it is a much more flexible method than the decision (which may prove faulty) to establish a bank, a chain store, a cinema or what not. It was easy in 1939, before this iron hand came down upon us, to put in a new bus service or take one off. We are not now even able to build a hen-house without someone having something to say. On the other hand, it was obviously never easy to rectify matters if we made a mistake about a shop, a bank or a chain store. In that sense we have here something very much wider in application than the former attempts at a division. As Mr. Green has shown, it is more universally applicable; it can be compared with results obtained in Denmark and with similar work in the United States of America and elsewhere; because they do not have anything similar to, say, Woolworth's in France or Finland one cannot make the same range of comparison with such criteria.

All sorts of fascinating queries arise in regard to the patterns of circulation one observes on the map and the contrast between purely agricultural areas and areas of other types. A point one would emphasize in the presence of professional planners is that these divisions represent divisions of human movements; they are human regions, and not regions showing the delimitation of rateable buildings. One of the dreadful things about planning is that those qualified to be planners must be drawn from three classes—at least so far: they must be either architects or engineers or borough surveyors, and they have all been brought up to think in terms of things, material things, and not in terms of humanity. Hence of course the tears that are shed by many of us.

In the section Mr. Green wisely omitted there is some very interesting matter, and I hope the paper will be published *in extenso* for it contains a suggestive analysis of the numbers and types of population within the areas; that is to say, primary, secondary, and what has been called "adventitious" population.

There is a great deal more I should like to say but it is clear that you wish to hear Mr. Green's reply to Professor Holford.

Mr. COPLAND: I feel I am rather a foreign body here in that my particular interest is not geography but market research. I am particularly glad to have the opportunity to add my tribute to Mr. Green's paper. I feel it is going to have an immediate and practical application in my work and, selfishly, I am looking at it from that point of view. It seems to me that this delimitation of the spheres of influence by means of the bus services is going to help me particularly, and others engaged in market research also. We are concerned continually with sampling the population for various characteristics and we come up immediately against the geographical divisions of our universe, for example London. I have been in difficulty to know exactly where I shall draw the line, more particularly round the conurbations which usually form one geographical division for our sampling. It is easy enough to select a number of administrative areas, group them together and call them the West Yorkshire conurbation, but when it comes to sampling round the edges and one has to instruct an investigator to sample here, there, or somewhere else, I am sure this method of delimitation will help

a great deal. I want to go away and apply as best I can the ideas I have had from Mr. Green.

There is another point at which this type of work cuts across the commercial side of things. There have been recently one or two surveys dealing more particularly with outdoor publicity by means of posters. In one I have recently seen, an attempt was made to assess the potential value of various posters placed in different towns and, realizing that people come in from the country, an area of approximately 10 miles round Leicester was chosen for the sample. It will be particularly interesting to me to see in a little more detail how Mr. Green has drawn his spheres of influence round Leicester and to what extent they coincide with the rather arbitrary choice made in this particular survey.

Mr. BEAVER: I would like to join in congratulating Mr. Green and his assistants on a memorable piece of work. Obviously the ordinary academic geographer could not spend the time it would take one man to obtain all the necessary information; even if he could, the bus services would have altered by the time he had the information. But I hope I shall not detract from the value of Mr. Green's paper by suggesting that I am still a little sceptical. I wonder how far this may be a question of the hen and the egg: which came first? Were the areas with community of interest in existence before the buses came, or did the buses literally create these things? And if the buses have created these spheres of influence, it is perfectly open, or was until relatively recently, for anybody to run a bus service wherever he liked. It seems that what Mr. Green has drawn is a synoptic chart. The picture drawn ten years ago might have revealed a different state of affairs and, even in our present planned world, another twenty years may reveal yet further changes. We might compare the Land Utilization Survey map which represents a synoptic chart of land utilization in the 1930's; the picture fifty years earlier was different; the picture now is different again. I have an uncomfortable feeling that if there were such a thing as *laissez faire* in the transport world, these hinterlands which Mr. Green has delimited would prove to be merely phenomena of the present day. In our planning wisdom we should be capable of altering them by ordering our buses to run for different distances along different roads. Perhaps I am barking up the wrong tree and Mr. Green may be able very effectively to answer me, but it seemed to me that there was no reason whatever for expressing surprise that his three hinterlands of Grantham coincided so neatly and precisely. Of course the journey to work coincides with the bus outline for the simple reason that people go to work in a bus. Of course those areas of the Boy Scouts' Association and the Mothers' Union, in Wiltshire, coincide with the bus routes because people have to use the buses in order to get to the centres. There is nothing surprising in that, but I cannot help wondering to what degree the simple whims and fancies of a few bus proprietors have literally created this synoptic chart that Mr. Green has shown. I would ask him, by the way, if Helmsley is not included on his map simply because it had a bus service to carry people to the cinema?

The CHAIRMAN: We had asked Mr. D. N. Chester, of Nuffield College, Oxford, to take part in the discussion, but he was unable to come. After reading the paper he made one point however which Mr. Beaver has also made, in suggesting that Mr. Green has drawn too static a picture in his bus map. No doubt Mr. Green will answer that criticism.

Mr. HUTCHINGS (Warden of Juniper Hall field centre): People go to a town like Leicester or Norwich to shop, for cinema entertainment and for various other purposes, just as people would go to quite a small country town. But these large towns offer also a whole range of highly specialized services to a

countryside quite beyond that of their Fourth Order function. The bus service method of investigation must tend to overlook this because people who travel to the bigger urban centres for specialized services may have to use other means of transport. Take the extreme case of London; for certain purposes its sphere of influence covers the whole of England and Wales, but people must usually travel to London by train. I feel that Mr. Green's method of survey cannot bring out the "ring within ring" pattern that such a map should show.

Mr. S. BEHREND: I was interested in Mr. Green's mention of how Marlborough had been affected by Swindon. When I was learning geography at Marlborough in 1936, Swindon was about the only place one could go to frequently by bus, though the shops there were then much worse than in Marlborough and elsewhere. I feel that the bus areas laid down some twenty-five years ago were planned to prevent competition; and people had to use the buses available.

What now influences a bus service as much as anything is perhaps the position of the garages. There was a time when one bus was kept in a shed, with two men to clean and drive it. That is what happened in North Wales in the early days, which are well described in 'The sowing of the harvest,' by Major Crossland-Taylor. That system is becoming more and more difficult, especially if double-deckers have to be used. The garage has to be in a centre and the journeys out to villages and back again, and the modern ideal is to have the garage near the middle of the run. An entirely new system of bus services may be created to take workers to and from a place; as at Harwell, where the Atomic Energy Research Establishment gives rise to a new centre. In my own village we suffer from not having the bus service we want because it serves a housing estate on the far side of a town at the other end of the route. The buses turn round half-way down, so that one half of the village is entirely rural. If in the future the Transport Commission chose to run any bus they could do so, and it seems to me there is something in Mr. Beaver's point that the routes do not appear to be static; but I do not think bus services will change very much during the next twenty years.

The CHAIRMAN: Mr. Behrend is not associated with the motor-bus industry, but he has one of the finest collections of bus time-tables in the country.

Mr. F. H. W. GREEN: I cannot, in reply, do justice to all the interesting points that have been raised, but I will answer one or two. First, to Professor Taylor's remark, I would like to say that I am not afraid of being awkward; lack of time prevented me from putting forward a number of points.

As to Mr. Behrend's remarks, what is happening as between Marlborough and Swindon obviously cannot be deduced from a map of 1947–48 conditions, and my statement that Swindon appeared to be gaining over Marlborough and getting some of Marlborough's catchment area was made as a result of opinions expressed by those who have made some study of the county of Wiltshire. I believe that, for certain purposes, Swindon has been gaining at the expense of its neighbours, although that conclusion is not deduced from the static representation.

As regards the static representation mentioned by Mr. Beaver and by Mr. Behrend, I would suggest that although the present investigation was based mainly on 1947–48 services, this "cross-section" represents very little change from the 1939 situation. This was more or less "frozen" until quite recently, owing to the shortage of vehicles and other factors. I showed the map demonstrating certain changes in Somerset during the last two years in order to indicate that things seemed to be easing again now, and the bus services are, as more vehicles become available, again beginning to reflect changes in demand.

Of course with the setting up of the Transport Commission, bus services may be planned on a different basis and one may not be able to assume that economic routes have been worked out by a process of trial and error. But that is a realm in which, following Professor Taylor's advice, I had better not be awkward.

Another interesting point, which I have myself thought about and which was raised by Mr. Behrend, was his reference to the work of the late Mr. Sydney Garcke, and the "area agreements" restricting competition between bus companies thirty years or so ago. This is purely an expression of opinion, but I do not believe that those agreements had as much effect as one might imagine. It was easy in the 1920's and 1930's for any other individual than a member of the combine to start a competitive service, and the big combines had not a complete monopoly. Mr. Behrend also mentioned factory and school bus services. We have done a little work on that too, but not enough to allow very much to be said. I would like to commend the study to anybody interested in seeing what an enormous network is now formed by special factory services.

Mr. Beaver expressed surprise that I should have seemed surprised that so many different types of functional hinterlands coincided. In fact I was not, but you would be amazed to find how many planning officers needed convincing that there was that kind of general coincidence! One has often come upon the assumption that the bus hinterland will not coincide with anything else and therefore one is at pains to emphasize the point.

I am glad Mr. Hutchings raised a point I had little time to develop; the conception of centres of higher orders of significance than the Fourth and Fifth. I agree with him that the bus service analysis is not applicable, to any great extent, to the study of centres of a higher order of significance than the Fourth; one has to use some other technique also.

Professor Holford, Professor Taylor and Mr. Beaver made reference to the time taken in carrying out such a survey as this. Although it has taken a good deal of time to collect the information and demonstrate the inferences which may be drawn from it, how much more time would have been taken in conducting a questionnaire It would probably be useful to give some examples of the time actually taken on this work. The collecting of time-tables for one Traffic Region of about six counties would take less than four or five days. For drawing the radial diagrams I estimate that I myself took about fifteen hours on Lincolnshire, and not more than another two hours to piece the jigsaw together and delineate the boundaries of the hinterlands. It was necessary to obtain a picture of the average situation as quickly as possible and I think that the time taken in so doing has been more than justified by the applications which we have already been able to make of the results. And it does not take such an inordinately long time.

I was much in sympathy with Professor Holford's knife analogy; that which is sharp is also dangerous. If time permitted I could quote a number of different interpretations of this map which would shock Professor Holford as much as they shocked me. I can only say that the foolish will misinterpret anything. When I once suggested that in some ways Swindon was comparable to Cambridge it raised gasps of horror. But there is in fact a close similarity in the area of the hinterlands and in the population of the towns and the hinterlands; in a sense Cambridge and Swindon have some very similar problems. Of course a person using the knife foolishly instead of sensibly might wrongly conclude that Cambridge and Swindon are similar in all respects.

Professor Holford asked whether bus services are more subject to competition from bicycles (and other forms of transport) in some places than in others. I think one can say that probably only in the United Kingdom and a few other

countries of Western Europe could one use the bus technique in the way we have been using it, simply because in general bus fares here are cheaper than those of any other form of public transport. I doubt if the technique would work out in the same way if applied to Belgium because there is not anything like the same difference between rail fares and bus fares; and it is whispered that it is one of the intentions of the Transport Commission to see that before long there will not be very much difference in that respect in Great Britain. During the war, the Social Survey demonstrated that for the daily journey to work buses were used by a considerably larger number of people in all parts of the country than other means of public transport. And only in East Anglia did the number using bicycles exceed the number using buses.

Finally, I am particularly grateful to Mr. Copland for indicating how this kind of map and the work associated with it can be used for commercial purposes. The wealth of our country is not yet based primarily on the activities of Government departments, and one likes to see that work done for administration and planning can be used in creating wealth in other ways.

The CHAIRMAN: I should like to congratulate Mr. Green on his extremely valuable paper. There are two points I would like to make because they were not made during the discussion. In the first place, I want to emphasize the great importance of this kind of work in the search for the best and most suitable areas for local government. We know that many existing local government areas do not correspond to realities and have no community of interest. If the areas for local government are to be recast—and it is high time they were—it is absolutely essential that a thorough survey be made of the relationship between all urban centres and their surrounding countrysides. We do not, even now, know all the facts. If they were collected, they would help to solve this problem of finding the best areas of local government.

It must be stressed that transport is not the only criterion involved in defining areas functionally dependent on a town. Mr. Green has shown that many other social factors are concerned, including the circulation of local newspapers. He has shown us maps of the wholesale distribution of food; such maps can be most illuminating, and of value to would-be reformers of local government areas.

My second point concerns the words used to convey the area functionally dependent on a town. We have this evening heard the terms "urban hinterland," "sphere of influence." "catchment areas"; all used by Mr. Green. It has been suggested elsewhere that the word "umland" should be used. Objections have been raised to "sphere of influence" because of its political flavour in other connections. Again, the term "urban field" has been introduced on a number of occasions by Mr. A. E. Smailes, and the most absurd objections have been raised against its use. It has been suggested that "urban field" conveys the notion of agricultural land inside a town. To my mind an urban field is similar to a magnetic field (a space possessing magnetic properties). In my personal view "urban field" is a perfectly good term for its purpose, in spite of what some writers have said in regard to its ambiguity.

I know you will all wish me to thank Mr. Green for an extremely interesting and most suggestive paper. He has given us an excellent example of what can be done when geography is applied to current problems. Thank you very much, Mr. Green.

F. H. W. Green

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URBAN HINTERLANDS
as determined by the study of
motor bus services
Centre of hinterland
Boundary of hinterland
Boundary of hinterland of subsidiary centre
Uninhabited area
London area
County boundary
Miles
10 0 10 20 30 40 50 60

F. H. W. Green

KARAKORAM SURVEY, 1939: A NEW MAP

P. G. MOTT

DETAILED ACCOUNTS of E. E. Shipton's 1939 expedition to the Karakoram[1] have already appeared. The surveys carried out on the expedition were compiled during the winter of 1939–40 in the offices of the Survey of India at Dehra Dun, and were in course of being embodied into the standard quarter-inch sheets 42.P, 43.N, 42.L and 52.A when interrupted by more vital work for the armed forces. Nothing further could be done towards the publication of the map until the war was over, when arrangements were made for the return of the original plane-table sheets and records from India to the Royal Geographical Society. Several attempts have been made since then to have the map fair drawn and reproduced, but they failed through lack of funds. Not until a decade after completion of the field work has it become possible to bring the results of the Expedition's work to a logical conclusion by the publication of the map. The necessary funds for this work have been subscribed by the Society, with a contribution from the Himalayan Committee.

The area covered by the map is one of considerable interest geographically, comprising as it does two of the longest glaciers outside polar regions and containing what is probably the greatest concentration of high peaks in the world. Before Shipton's Expedition the only maps of the region were based on sketch surveys by Conway and, later, the Bullock-Workmans, which provided only a hesitant outline (often wildly in error) of this vastly complicated piece of terrain. Due to the political changes in India since the expedition took the field, it seems unlikely that an opportunity will occur again for many years for the employment in the Himalayas of a fully trained survey team on a private venture of this nature. Added to which, the recent developments in Sinkiang and the present uncertainty in Kashmir must necessarily give the map an added importance. The following notes are intended to fill in some of the technical details which could not be included in previous more general accounts of the expedition.

The Hispar Triangulation

While the methods used were not original, the scale of the country involved us in a number of problems the magnitude of which was not at first appreciated. Most of our troubles arose from the initial mistake of not adhering to Shipton's original plan to begin the survey from a measured base on the Lukpe Lawo ("Snow Lake") and thence extend a triangulation outwards which would be tied on to the few existing G.T.S. points in the area. The Survey of India, to whom we were much indebted for having lent us two experienced plane-tablers and for contributing generously to our funds, was anxious to establish if possible a connection between the G.T.S. stations in the Hunza valley, belonging to the Indo-Russian triangulation carried out by Mason in 1912–13, and the few isolated points in "Snow Lake" area such as peak 18/43M ("Ogre") and peak 9/43M ("Ganchen"), which belonged to the much older Kashmir series carried out in 1855–60.

Had there been sufficient time, instruments and personnel available, the

[1] E. E. Shipton, "Karakoram, 1939," *Geogr. J.* 95 (1940) 409; P. G. Mott, "1939 Karakoram expedition," *Himalayan J.* 13 (1946) 9.

Survey of India plan would have been by far the most satisfactory way of tackling the job, but we had only one theodolite accurate enough for a triangulation of this order and one surveyor to use it. Moreover the majority of the triangulation stations lay between 6000 and 8000 feet above the valley floor. In addition the observations had to be computed fast enough to keep two plane-tablers busy. Although Shipton assisted me greatly both by his profound knowledge of the country and a remarkable gift for recognizing peaks from widely different angles, the difficulties in carrying an accurate network of triangles over a distance of 60 miles in such country in the space of a few weeks need no elaboration. To have completed the task satisfactorily in the time at our disposal, at least three observers and a computer must have been available.

To add to our troubles the weather was often unfavourable and we were many times held up for several days by mist, rain and dust avalanches. Water and fuel are scarce in the region, making camp sites hard to find and adding to the exertion of the climbs. Even in the best circumstances it took two days to complete a single station, while on occasions five days were taken up by one point.

As things turned out the time spent on the triangulation was disproportionate to the work of the Expedition as a whole. Much interesting exploratory work behind the south Hispar Wall and north of the Upper Biafo watershed had necessarily to be curtailed, nor were we able to make a detailed survey of the Alchori and Chogo Lungma glaciers which were included in our programme. Sadly enough, despite these sacrifices the primary object of establishing the connection between the Indo-Russian and Kashmir series, which had caused our change of plan, was never completed on account of an accident to the Wild theodolite.

Some confusion and delay was due to the Survey of India triangulation pamphlet 42.L, which gives a very misleading description of both the stations belonging to the Indo-Russian series in the Hunza valley which we had hoped to use as a base for the commencement of the survey. "Zangia Harar" is not, as described, "on the higher and more northern peak" of the hill of that name but is at least 50 feet below the top and 100 yards to the east. Still less is "Buru Harar" on the "highest accessible point of the ridge"; it is situated on a very inconspicuous spur in the Hunza valley 2000 feet below the summit of the ridge (climbed by us without difficulty) and was invisible even from a mile away to the west without the use of a helio. Misidentification of the latter station involved us in a great deal of trouble and delayed us by nearly a week. Finally we were obliged to abandon this station altogether and lay out a fresh base near Nagar, south of the Hispar river. The new base was later connected with Zangia Harar so that spherical co-ordinates could be computed. No reflection is cast on the Indo-Russian triangulation which was a fine piece of work carried out in extremely severe country. Nevertheless it seems a pity that, in a region where there existed little or no triangulation data, the stations were not selected on more conspicuous points that would have been of service to other surveyors.

The Nagar base was laid out by double extension from a Wild subtense bar. The Survey of India had offered us a Hunter "Short Base" before our departure (a more accurate apparatus than the subtense bar and ideally adapted for this type of work); regrettably we did not take it on account of the added weight.

The speed of progress prevented us from measuring all three angles of every triangle of the network. However, the work was computed as it progressed and a constant check maintained not merely on the stations but also on the intersected points which could be verified by the plane-tablers. The usual trouble

20,000 foot peaks bordering the Hispar glacier on the south

Plane tabling at 16,000 feet; Sosborne glacier

Triangulation station above the Hispar glacier

in exploratory triangulation of being unable to reconnoitre ahead necessitated a number of satellite stations, and corrections had to be made for these. Eight-foot cairns were built on all stations and proved sufficient for the longest ray (10 miles). A lime wash on the cairns would have been of great assistance in identification and would have added little weight to our loads. The stations were established in all cases on conspicuous points, mainly above 16,000 feet. Even without the cairns it should be possible for anyone to find most of them in the future from the description of the points, copies of which are held by the Survey of India, and by the Society's Map Room. We had neither the time nor the material to construct more permanent marks, but the cairns were strongly built and should last unless pulled down by local shepherds.

Accident to the Wild theodolite

After five weeks of intensive work the triangulation was within 10 miles of the Hispar pass. We were camped on the northern bank of the Hispar glacier below a hill that had been given the name "Dromedary Humps" on account of two small excrescences on the top. A spell of bad weather had just begun and the first day I was unable to observe owing to cloud; I went up a second time alone and set up the Wild on the southern of the two Humps, which consisted of an enormous pile of heterogeneous boulders. The uppermost rock, on which I was standing, must have weighed several tons and appeared securely lodged, but rain and thaw had undermined the stability of the pile and as I transferred my weight on to the outer edge of the boulder in order to level the instrument there was an ominous rumble beneath and the whole mass suddenly gave way. I was thrown downhill, the theodolite following closely behind. I escaped unhurt from the fall but the Wild received damage to its main axis and was out of action for the rest of the summer. The main object of the triangulation was thus brought to an untimely end. Fortunately we still had the small Zeiss TAL photo-theodolite reading to $1'_2$ minutes which was used to supply the plane-tablers with control by a series of resections, making use of those points already established with the Wild T.2. before the accident, in addition to the G.T.S. points provided by the two Kanjut peaks (Pk 11/42P and Pk 12/42P) and the unnamed peak 18/43M.

Plane-tabling

Most of the detailed mapping was carried out by two Indian plane-tablers, Fazal Ellahi and Inayat Khan, lent by the Survey of India to assist the expedition during the summer programme. Fazal Ellahi had already fourteen years' experience in Himalayan mapping and it would have been difficult to find his equal for accuracy, speed and resourcefulness. His out-turn was quite remarkable and can be gauged from the fact that in the course of three months' work he surveyed in great detail a total area of approximately 600 square miles, much of it above the snow line at 14,000 feet, and including the entire area of the Lukpe Lawo ("Snow Lake"), the whole of the Biafo glacier and two-thirds of the Hispar. Inayat Khan although a younger and less experienced man also produced some excellent work. As he was unwell for the first few weeks, probably due to slow acclimatization, he was left to complete the lower third of the Hispar glacier, the Kunyang and Gharesa glaciers and some of the country around Nagar.

Both surveyors suffered to some extent in their work from an insufficiency of control points. Due to the accident with the Wild, Fazal Ellahi was obliged to work his survey of the Biafo glacier (an area of some 200 square miles) off not more than six triangulated points. For the greater part of the time the surveyors were left entirely to their own resources. Much of the work had necessarily

to go unchecked, but whenever examined it proved of an extremely high standard. Fazal Ellahi's clinometric heights of the Hispar pass and most other points in the Snow Lake area agreed almost exactly with my triangulated values. It was definitely established that the Bullock-Workman's estimates of peaks on the south Hispar Wall and in the vicinity of the Snow Lake were in error on the high side, by as much as 3000 feet in some cases.

After completing the triangulation, Russell and I crossed over from the Biafo into the deep-cut valley of the Sokha (old "Cornice") glacier, said by the Workman's to have no outlet. Here I was faced with an awkward problem. There were no fixed points whatever available, while only a week had been allotted for a very difficult and intricate area. Luckily we had with us the Wild telescopic alidade which I used to build up a graphical "triangulation" from an assumed base across the glacier. Azimuth I obtained from observations of *Polaris* at (or near) elongation. The plane-table was oriented correctly over a known station just before the computed time of elongation. The alidade was then moved until the vertical cross-hair of the telescope was on *Polaris*. True north was thus indicated by the edge of the sight rule, plus or minus a correction which could be obtained from the *Nautical Almanack* and laid off graphically on the board. Later I "tied on" to two points on the south Hispar Wall which enabled me to reduce the whole survey to a known scale and transfer relative form-lines to contours of known value. The method is not one that commends itself except as a last resort in the absence of any triangulated points; with an ordinary sight-rule it would have been impracticable.

Leaving the Sokha and Solu area, Russell and I travelled to Askole where we parted company. With one Sherpa and two local men I then began the survey of the Hoh Lungma and Sosbon glaciers from the south. Here my task was very much easier. From the summit of a high ridge west of the Hoh Lumba valley one overlooked the whole of the Sosbon and Hoh Lungma glacier systems. Peaks 12/42P, 18/43M, 9/43M, were all visible and the survey began with an accurate fix. Several other points that I had hoped to make use of for plane-table fixings proved either untrustworthy or non-existent. The Workman's 22,000-foot Peak "Meru," between the Hoh Lungma and Biafo glaciers, was mysteriously absent. Koser Kunge (35° 37′ 10″ N., 75° 39′ 00″ E.) was visible far to the south, but did not appear reliable either in height or position. Mango Gusor (Pk. 21/43M) was not visible. The survey was necessarily of a rapid nature but it may be fairly claimed that the glaciers and surrounding ridges are accurately placed. At each station a round of photographs was taken on 35 mm. film which cover nearly the whole area of the survey. With the help of these it has been possible to work up all the detail left out in the field.

Photographic survey

The Panmah, Choktoi and Nobande Sobande glaciers were surveyed by Shipton, using the Zeiss TAL photo-theodolite, which had been obtained on loan from the makers. Later, at Dehra Dun, the photographs were plotted and the result is highly satisfactory; the method used, that of plane-tabling from single photographs, is one of the earliest forms of photo-surveying. It is ideal for use in high open country when time in the field is limited and personnel not highly trained. An account of the methods used is added as an appendix to this paper, and is based on our experiences with the Panmah survey. Save for a small area at the head of the Gharesa glacier, surveyed by Fountaine, and some pictures taken of the head of the Khurdopin, no other photo-survey was carried out. The programme of stereo-survey planned for the winter never materialized on account of the war.

APPENDIX

The single picture method of photographic mapping

The instrument used was the Zeiss TAL photo-theodolite, which is admirably designed for exploratory surveys of this type. The instrument in its case with all accessories and stand has a total weight of 14¼ lb. Horizontal and vertical angles are read in grads with a direct reading to one-tenth grad and an estimation to one-hundredth. In practice the horizontal angle was found to be accurate to within 1½ minutes. For the sake of lightness we used film pack instead of plates, which worked satisfactorily. The size of the contact negative is 6·5 × 9 cm. The method employed was based on the combined use of the instrument both as a theodolite and as a photo plane-table, and is to be recommended wherever time in the field is more important than convenience in office compilation, and also in cases where stereoscopic photogrammetry is impracticable due to lack of trained personnel or insufficiency of time. The area mapped by this means covered the whole of the Panmah, Choktoi and Nobande Sobande glacier systems, an area of some 200 square miles, mostly lying between 13,000 and 24,000 feet. The whole of the field operations and photography were carried out by Shipton in the course of three weeks' work, the total number of stations occupied being approximately twenty. In the selection of these stations the following points were borne in mind:

The higher the station the less dead ground there is and the wider is the valley separation.

Pairs of stations were so placed as to obtain good intersections on the country mutually embraced by them.

Points in the area included by one station must be recognizable when seen from the second station. The surveyor (in this case, Shipton) must be constantly identifying himself with a plane-tabler faced with the problem of cutting in small points of detail he has observed from a previous station.

Whenever possible the stations were intervisible. On arrival at a station the first consideration was given to the photographs. These were taken near midday if possible, when shadows were absent. If however there was any danger of low cloud forming, the photography was carried out immediately on arrival and the pictures repeated again later if conditions improved. Horizontal and vertical angles were taken to as many prominent peaks as time permitted, including all points triangulated by Spender[1] in 1937 and the old G.T.S. points.

The following records were kept:

(*a*) A list of all control points observed with a reference number and a description of each, and the station number from which they were observed.

(*b*) A list of all photographs taken at each station with their serial numbers, the angular interval of their principal planes and the displacement of the horizontal axis of the camera from its central position (equivalent to tilting the axes in other types of instrument).

(*c*) Horizontal and vertical theodolite readings.

For convenience and to save space all three sets of recordings were kept in one small notebook.

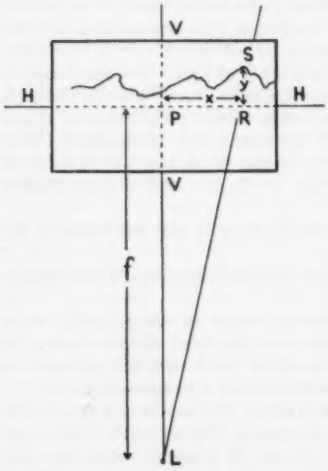
On the return of the expedition to Dehra Dun, the compilation of the Panmah map was immediately begun and took, in all, three months to complete. The compilation and drawing of the map was carried out in the following stages:

1. *Existing control.* All existing triangulated points were first plotted on a sheet of backed or "rectostat" paper to a scale of half an inch to one mile.

[1] *Georgr. J.* 91 (1938) 331.

2. *Kodatrace protractors.* A number of Kodatrace protractors were prepared of at least 5 inch radius. These were printed in ink on the glazed side of the Kodatrace, the circle being divided in degrees and tenths of a degree, every ten degree interval being numbered, so that when the protractor was viewed from the reverse (matt) side the numbers appeared the right way round and progressed in a clockwise direction from 0 to 360. There was one such protractor for each station, the number of which was marked in the corner.

3. *Resection of stations.* All observed angles from the stations were next set out on the matt side of their respective protractors, the number of each ray being marked against it on the outside of the circle. The resection of the stations then began. That station from which the greatest number of existing trig. points had been observed was taken first and, by sliding the protractor over the plot so that each of the trig. points lay on its respective ray, the resected position of the station was found graphically, pricked through, marked with a circle, and numbered on the plot. The remainder of the rays were then marked in pencil off the edge of the protractor on to the plot with their numbers. The principal lines of all photographs from the station were also transferred to the plot. In the same way the position of the second most favourable station was found and any common points between the two stations so far taken were intersected and used as additional control for fixing the third station, and so on until all the stations and new control had been plotted.



The stations were marked with small crosses in red ink and control points circled in black with their numbers in pencil. The heights of all points and stations were next computed and a height trace prepared. Everything on the plot was then erased leaving the stations, control points and principal lines of the photographs and any odd rays, the points of which had not been intersected. (These latter rays of course remained in pencil.)

4. *Photographic prints.* All prints were full plate enlargements ($8\frac{1}{2} \times 6\frac{1}{2}$ inches). Two prints were made from each negative, one matt and one glossy. Each enlargement was carefully checked to make sure there was a minimum of distortion in the print; especially with distant points, small errors of measurement on the print may amount to very large errors on the plot. As apparatus was not available to ensure that each print was enlarged by exactly the same amount, it was necessary to compute the principal distance for each individual picture. This was entered up in ink on the back of the print. The collimation axes were then drawn on the glossy copies *only*, using a fine pen or pricker.[1]

[1] If f_1, h_1, v_1 are respectively the focal length of the camera, the horizontal distance between the collimation marks, and the vertical collimation distance referred to the pressure plate; while f_2, h_2 and v_2 are the corresponding values for the enlargement (f_2 is the principal distance in this case) then it is clear that:

$$f_2 = \frac{f_1 \times h_2}{h_1} = \frac{f_1 \times v_2}{v_1}$$

5. *Plotting of detail.* On the glazed side of a piece of Kodatrace a cross was then drawn (see figure) and a distance equal to f_2, the principal distance of the enlargement, was marked off along the tail of the cross. This was placed in position on the plot with L on the station and LP along the principal direction of the photograph as marked on the plot. The ray to any point S on the photograph was next drawn by transferring the distance x from photograph to Kodatrace, laying a straight edge along LR, and ticking the ray off on the plot sheet. At the same time the distance LR was measured on the Kodatrace and y on the print: these were entered up on a form (y/LR is the tangent of the vertical angle to the point). Any control points that could be identified on the print were used to check the accuracy and the direction of the principal line, and also the presence of any distortion in the photography.

All photographs relating to a particular area were finally assembled and points of detail picked out and marked up with numbers in red ink on the matt copies. Glossy prints were used for measurement only and were not marked or defaced in any way except for inscribing the collimation axes. The drawing of the map then resolved itself into straightforward plane-tabling, in the drawing office instead of the field, and requires no further description.

REVIEWS

EUROPE

THE BATTLEFIELDS OF ENGLAND. By ALFRED H. BURNE. *London: Methuen*, 1950. 8½×5½ *inches;* 310 *pages; sketch-maps and panoramas.* 21*s*

No one is better qualified than Colonel Burne to correct the many errors which have been perpetuated by historians regarding the topography and sequence of events of the battles which have punctuated English history. He possesses a good eye for country, and has visited every battlefield of note, both in this country and on the Continent. That his historical sense is also of a high order is testified by the foreword written by that great historian, G. M. Trevelyan.

After a thorough study of the local topography, the author analyses nineteen English battles, ranging from King Arthur's victory over the Saxons at "Mons Badonicus" in the sixth century to Sedgemoor in the seventeenth. We may share Dr. Trevelyan's scepticism regarding his conjectural location of the former, though the arguments are convincing. This book should be on the shelf of every military historian and of every historical geographer. Unfortunately it is marred by some forty misprints, which are particularly annoying where they occur in the references to the sketch-maps. The latter are clear and helpful, but in No. 24 the 375 foot contour joins up with the 400 one. The author has well and truly digested all the available sources of information, and provides an excellent bibliography. It is to be hoped that he will follow up this book with an account of the battlefields of Scotland; besides settling various controversial points about Bannockburn and Dunbar, he might throw fresh light on the site of Agricola's victory over the Caledonians at "Mons Graupius."

J. H. M-C.

A SURVEY OF THE CHESTERFIELD REGION. By K. C. EDWARDS and F. A. WELLS. *Chesterfield: Regional Planning Committee*, 1949. 7×9¾ *inches;* 126 *pages; maps and diagrams*

This Survey was undertaken at the invitation of the Chesterfield Regional Planning Committee which was responsible for planning in North-east Derbyshire until the creation of the present Country Planning Authority. In their preface the authors make their approach to the planning problems of the area quite clear. They emphasize that regional planning is essentially a practical matter, and the reader senses their feeling that not all planners appreciate this fact. The purpose of the survey is "to present a broad conspectus of past and present conditions in the Region and an estimate of tendencies especially in relation to the growth and distribution of population and to industrial development." The authors also state that in their view, for the purposes of regional planning, the value of a close investigation of social conditions, based on direct household enquiry, is liable to be exaggerated. With this view the reviewer is wholly in agreement.

The Survey is concerned with the borough of Chesterfield and the surrounding area, comprising four urban districts and two rural districts; in all an area of about 170 square miles with a population of some 200,000. Treatment is systematic and deals with the physical setting (which though brief is very well handled) the settlement pattern, communications, public services, population, the industrial structure and a review of the chief industries and their prospects, housing conditions, the problem of subsidence, and the provision of amenities. This is followed by general conclusions.

Geographers will appreciate the emphasis placed upon physical factors particularly in their influence upon the settlement pattern, transport routes and the subsidence problem, and the effects which they will have upon future development. The "region" shows many of the planning problems characteristic of old-established coal and iron areas—in addition to the subsidence problem there is the legacy of fragmentary settlement, poor housing conditions, and the lack of employment for women. To these problems is added that of spatial relationships, particularly that with the spreading Sheffield.

The Survey is well illustrated with over 30 maps and a number of diagrams. In Figure 30 (Distribution of Collieries), the scale of output needs correction, and the scale of numbers employed does not seem to agree with the table given on page 74. Neither of these maps carries the date to which the statistics refer. Despite such points, the maps as a whole have the great merits of simplicity and clarity.

Although designed as a planning report, the Survey is in effect the geography of a small area, and as such it is a very useful contribution and will be welcomed by geographers. It shows the value of a geographer and an economist working together. A. A. L. C.

A HISTORY OF MOUNTAINEERING IN THE ALPS. By CLAIRE ELAINE ENGEL. *London: Allen and Unwin*, 1950. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* 296 *pages; illustrations.* 21*s*

Two circumstances make Mlle Engel's book noteable: it is the first comprehensive survey of mountaineering in the Alps in the English language, and it has been written in what to its author is a foreign tongue yet with great lightness and idiomatic humour. The list of authorities she consulted shows the extent of research which went to the preparation of the book, but facts are not allowed to clog her pages and a clear picture of the evolution of mountaineering emerges. The preoccupation of the early climbers with geology, physics and botany is traced, followed by the gradual development, mainly by Englishmen, of mountaineering as a sport for its own sake. Some of the most celebrated incidents in mountaineering history, for example Whymper's Matterhorn tragedy, are insufficiently documented for the facts to be beyond doubt; but in the main Mlle Engel's research has enabled her to write a well authenticated history. In addition she conveys, partly by well selected quotations, an excellent impression of the attraction which mountains exert on their devotees.

R. S. R.

ASIA

BENGAL IN MAPS. By S. P. CHATTERJEE. *Calcutta: Orient Longmans*, 1949. $11\frac{1}{2} \times 9$ *inches;* iv+105 *pages; maps.* Rs. 18

In his foreword to the Atlas, the Minister of Industry and Supply to the Indian Union describes its maps and texts as providing "a fairly complete socio-economic picture of contemporary Bengal." Pointing out the importance of maps for national reconstruction, he instances the "three million roubles" spent on the Soviet World Atlas, and justly remarks that "what Dr. Chatterjee and his co-workers have produced with negligible resources deserves every praise."

Upon Map 1 (Divided Bengal in divided India) and Map 2 (Greater Bengal), the author remarks that "community of language will continue to be the most powerful unifying factor of Greater Bengal," Bengali extending as the principal tongue beyond the provincial boundaries, both before and since Partition. Of the partition line dividing West Bengal from Eastern Pakistan, he remarks that if the Boundary Commission had had certain maps before them (*e.g.* Maps 33 and 34) a more reasonable partition might have been effected

without disrupting local transport or cleaving areas of regional unity. (See *Geogr. J.* 110 (1947) 207–22.) The commentary avoids communal bias and the atlas is serviceable on either side of the Partition Line.

Of the 80 maps, which are mainly in dot form or ruled as cartograms, most are full page size and on a scale of approximately 52 miles to the inch, a few crop distributions being shown to a fifth that scale. A grid frame permits proper reference to location. Maps 4 to 7 are "physical" and 8 to 22 climatic; 23 to 42 concern population (including minorities); 43 to 71 are agricultural, and the remainder concern industry (with industrial sites), education and health, and communications. Map 4 roughly indicates the significant low contours at 25, 50 and 100 feet, not easily found in published works. There is no attempt to show the prevalence of flooding in the east, and the inadequacy of the text on rivers exemplifies the need for research. As to climate, more might have been shown, and written, about the variability of rainfall and rice-growing in the drier west where flood-waters are lacking; the work of P. C. Mahalonobis would be suggestive. The population maps largely represent the statistics of the Census of 1941; a dot map is quite eloquent as to modulations in density. Change in successive decades shows the regional contrasts from 1911 onwards to 1931 when growth was mainly in the east. The growth, which continued in both east and west Bengal until 1941, was followed in 1943 by the famine in east Bengal—a reversal of previous conditions. An attempt to indicate the importance of the famine is made by dots showing the distribution of deaths in 1943 (Map 79); naturally it resembles the population density map and it fails in its object, for many destitute persons died after leaving a famine-stricken home for some other region such as Hooghlyside. War-time economies led to an absence of maps in the Census Reports and, as so much has happened since and is happening now, the atlas fills a real need.

Inevitably, the weakest maps are those for agriculture, owing to the unreliability of the statistics. It is pathetic that although detailed surveys for the settlement of land revenue are made, at long intervals, in one district after another in rotation, their findings have not, for lack of an inter-departmental link, been correlated with the annual statistics for the same area and year. A case in point is that of current fallows—a sign of decadence in certain areas in the west—and no attempt is made to map them. Nevertheless, the broad distributions emerge as in no previously published maps and Dr. Chatterjee's field studies have given him a basis for judgment in choice and commentary. In brief, the high productivity of the east stands out in contrast to the low productivity of the west of Bengal.

Perhaps the most serious omission in the atlas is any precise reference to the sources or an assessment of their relative reliability, however brief. An author who knows which of his sources are reliable and which are not should inform his reader, who is otherwise forced to trust all of them or none. An author's own inaccuracies (of which there are a few here) can also be checked.

The publication of a British edition, now announced, is to be welcomed. And it is to be hoped that its text will have been read by a careful editor who will render in English such local and provincial terms as the common terms for crop seasons and locations. A. G.

OUTER MONGOLIA AND ITS INTERNATIONAL POSITION. By GERARD M. FRITERS. *Baltimore: The Johns Hopkins Press*, 1949. $9\frac{1}{4} \times 6\frac{1}{4}$ *inches;* xlvii+358 *pages; maps.* $5

In view of the momentous developments in Sino–Soviet relations during the past eighteen months the appearance of Mr. Friters' book on Outer Mongolia

is particularly timely. For, thanks to its geographical position, Outer Mongolia or, to use the current official designation, The Mongolian People's Republic, must inevitably play a critical role in the relationships between the two great states which border it on opposite sides.

Mr. Friters' book, which is fully documented and contains an exhaustive bibliography in Chinese, Russian, Ukrainian, English, French and German, is clearly an outstanding contribution to our knowledge of this remote corner of the Asiatic "heartland." Its treatment is avowedly from the viewpoint of the specialist student of international politics, and the major part of the work consists of four chapters dealing respectively with the relations between Outer Mongolia and Russia, China, Japan and other Powers. While there is no doubt much to be said by the expert in favour of such an arrangement, it has serious drawbacks from the point of view of the more general reader who will certainly find it extremely difficult to form a clear impression of the interrelationships between the various matters discussed, and of their bearing on the internal evolution of the country itself.

To the geographer however, the principal interest of the work will probably lie in the remaining chapters, notably that on Geography and Society, and in the excellent introduction by Professor Owen Lattimore, which together present a fascinating picture both of the country and of the changing nature of Mongol society during the past thirty years. Professor Lattimore stresses the continuity of Russian policy through Tsarist and Soviet times, and lucidly contrasts the effect of this with the menace to the Mongol pastoralists presented by Chinese settlement within their borders: "From the Mongol point of view, even before 1911, the most pressing danger was not the "colonial" control of their country by a few foreigners representing a foreign government, but actual *colonizing* of the best part of their land by Chinese settlers; not subjection, but displacement; not the fate of India, but the fate of the American Indian."

The overwhelming predominance of livestock breeding in the economy of Outer Mongolia is well brought out, but Mr. Friters refutes Maiskii's sweeping statement that "there is no scope for agriculture." Such, it is clear, is not the view of the present Mongolian government which has encouraged cultivation especially in those areas formerly farmed by the Chinese. Nevertheless it seems certain that neither agriculture nor manufacturing, which has also received considerable government assistance, can ever hope to absorb more than a limited proportion of the country's total population (at present in the vicinity of 1½ million, in an area roughly seven times as large as Great Britain) and that the best economic prospects for the future lie in the further improvement of the livestock industry. In this respect Mr. Friters' remarks on the possibility of Mongolia's becoming a major supplier of meat to the adjacent areas of the Far East are the more interesting in view of current political developments in that region.

The book appears to have been completed before the extent of the Communist victory in China could reasonably have been foreseen, but the course of events since that time has done little to detract from the soundness of the opinions expressed and serves rather to increase the value of this important addition to the available literature on Inner Asia. C. A. F.

TWO MOUNTAINS AND A RIVER. By H. W. Tilman. *Cambridge: University Press*, 1949. 8¼ × 6½ *inches;* xii + 233 *pages; maps and illustrations.* 21*s*

The subjects of books reviewed in this *Journal* reflect the trend of modern geography; detailed studies very properly replace the more discursive travellers'

narratives of earlier times. It is therefore the more pleasing that Mr. Tilman recovers the mood of an earlier generation who travelled widely in almost unknown terrain and were keen amateur observers both of country and people.

An unsuccessful attempt on Rakaposhi with a mainly Swiss party occupies the first chapters—thereafter he travels with Mr. Shipton in Turkestan—finally a brief imprisonment on his return via Afghanistan. The whole story is told with Mr. Tilman's particular brand of dry self-effacing humour, which has been compared justly with that of Beachcomber or the Marx Brothers.

Some, no doubt, will regret that an elaborate scientific programme was not undertaken. The maps on page 101 show however that the expedition did in fact produce data of topographic value and no one who has seen Rakaposhi soaring above the Hunza valley can feel that an attempt to climb that mountain was not ample justification for the expedition. One can only regret that few men trained to make detailed observations are as skilled as Mr. Tilman in the art of travel.

The quality of the illustrations is the one discordant feature of the book. Mr. Tilman apologizes for the behaviour of his camera but the fault is not his. Some of his photographs have also been reproduced in the *Himalayan Journal*, 15 (1949), others by his Swiss companions appeared in *Berge der Welt*, 4 (1949). Mr. Tilman's publisher could profitably compare the excellent illustrations in these two journals with his mediocre reproductions of the same photographs.

R. S. R.

LITTLE VEHICLE: Cambodia and Laos. By ALAN HOUGHTON BRODRICK. *London: Hutchinson*, 1949. $8\frac{1}{2} \times 5\frac{3}{4}$ *inches;* 266 *pages; map and illustrations.* 21*s*

The title 'Little vehicle' is a translation of the name given to the Hinayana or "southern" form of Buddhism prevalent in Cambodia, the area with which this book is primarily concerned. The book is a companion volume to the same author's "Little China," published a few years ago and dealing with the Annamese lands of Indo-China, but Mr. Brodrick has been at pains to suggest that the two areas have little in common beyond the diminutive, or at least derivative, character of their respective civilizations.

The publishers' own assertion that this is "an unusual travel book about a fascinating and little-known part of Indo-China" is apt, though it must be admitted that "unusual" is probably the operative word. Both the author and his publishers appear to believe that "straightforward travel-books" must necessarily be pedestrian, and also that systematic geographical and historical description, even of a colourful and non-technical variety, will frighten off all but a handful of readers. Thus Mr. Brodrick who, unquestionably, could have written a first-class book of either of these two sorts has in the end produced one that falls into neither category and will satisfy only the dilettante. To the serious reader the habit of interspersing really valuable and thought-provoking observations on archaeology or early history with not very interesting personal reminiscences of travel in pre-war Europe is irritating, as is the author's even more frequent practice of airing his own particular prejudices on a wide variety of topics, most of them largely irrelevant to the theme of his book.

These are perhaps unkind criticisms in view of the considerable merits which the book possesses. The author's ability to combine a keen eye for country with terse yet imaginative powers of expression is illustrated by such passages as the following (p. 201): "The sea unites. The land divides. And particularly is this true of Asia. The continent is a roof sloping northwards to the cold and tundra,

and southwards broken by gables into compartments between which communication by land is not easy. On the other hand, the southern shores of Asia are broken with good harbours and washed by seas whose navigation for much of the year is easy and commodious." And repeatedly one is struck by vivid flashes of insight into the nature of the Cambodian way of life and the effect upon it of external contacts both ancient and modern. No student of south-east Asia can, in fact, afford to neglect this volume, and many other readers also will doubtless find much in it to interest them.

Nevertheless, the reviewer feels compelled to protest against this latest example of a growing tendency on the part of highly competent authors to assume that good descriptive writing, unadulterated by numerous quotations in a medley of foreign languages and lengthy soliloquies concerning the meaning of life, art, reality, etc., is either beneath their own dignity or above the general public's head. The publishers are indeed right to stress that, for all its fascination, remarkably little is known in this country about Cambodia and the rest of Indo-China. But it is equally true that Mr. Brodrick might well have done a great deal more to dispel this ignorance had he written a book which, though no less interesting or subjective, was not so consciously and deliberately "unusual."

C. A. F.

SOUTH AMERICA

WUNDERLAND PERU. By ARNOLD HEIM. *Bern: Verlag Hans Huber*, 1948. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches; 301 pages; map and illustrations. 42s*

Although the author, Mr. Arnold Heim, is primarily a geologist, his interests and his sympathies are so wide that this superb volume, illustrating every phase of the Peruvian pageant, could not fail to charm and interest even the least scientifically minded reader. The excellent photography (Mr. Heim has a keen and discriminating eye for the composition of a picture) and the high quality of the reproductions would alone make it worthy of a place on the shelves of any geographical or travel library.

In addition to 270 black-and-white photographs, this important book on Peru is embellished with 42 line drawings, a map and 12 full-page coloured photographs. Of these last the landscapes are the least satisfactory, for the blues and greens are inevitably slightly reminiscent of coloured postcards. The aerial photographs are a notable feature. A panoramic study of the contours of the lava-scared, water-worn slopes and gullies of El Misti make it abundantly clear, to those of us who have spent long days collecting botanical specimens on the volcano's flanks, why places, which in that crystalline air looked as if they could be reached in a forty-minutes' walk, often necessitated four hours of arduous going, and sometimes in the end proved to be inaccessible to one of riper years. The pre-Colombian monuments of Peru are well represented by fine studies of Sacsahuaman (considered by Hiram Bingham the most stupendous ancient construction of the Western Hemisphere), the Incaic masonry of Cuzco, the coastal place of worship, Pachacamac, and the world-famous ruins of the Urubamba valley, Machu Picchu. Notable among these last is a panoramic study of the ruined city with the peak of Huayna Picchu and the distant Cordillera making a magnificently dramatic background.

Mr. Arnold Heim's photographs, which are of outstanding quality, are perhaps —even for readers completely at home in German—likely to arouse greater enthusiasm than the reading matter, although the text of his book is full of meticulously accurate information, set down with sober precision. 'Wunderland Peru' deserves to be widely read, and would be an admirable guide to the wayfarer anxious to travel off the beaten track in a country which has a perennial

fascination and interest. And if the text of Mr. Heim's book might at times seem to illustrate the truth of the generalization that in literature it is often the German who gathers the fuel and the Frenchman who kindles the fire, it is well to remember that all good travel books must in the first instance be based upon facts accurately observed and noted. At a time when there is an unhappy tendency for iron curtains to multiply all the world over, every reader who can only hope to *faire un beau voyage* in an armchair by his own fireside will owe Mr. Heim a debt of gratitude. C. S.

AUSTRALIA AND PACIFIC

AUSTRALIA. Edited by C. HARTLEY GRATTAN (United Nations Series). *Los Angeles: California University Press (Cambridge: University Press)*, 1947. $8\frac{3}{4} \times 6$ *inches;* xxviii+444 *pages; maps, diagrams and illustrations.* 27*s* 6*d*

NEW ZEALAND. Edited by HORACE BELSHAW (United Nations Series). *Los Angeles: California University Press (Cambridge: University Press)*, 1947. $8\frac{3}{4} \times 6$ *inches;* xvii+329 *pages; maps, diagrams and illustrations.* 27*s* 6*d*

'Australia,' in the United Nations series of the University of California Press, represents a considerable achievement. In twenty-eight chapters, filling 413 pages, the editor has directed the work of thirty authors in the telling of the story of the development and the character of the Australian nation. The plan is coherent and logical. Seven parts, of varying length, carry the story from a geographical sketch of the Continent itself through the historical background, the constitutional, political, economic and social development to cultural aspects, Australia in the Second World War and finally to some aspects of the post-war situation. The work as a whole is historical in concept, and the individual authors, almost without exception, have adopted an historical approach to their topics. A good deal of repetition is necessarily involved, but the editor must be congratulated on his skill in solving a very difficult problem. He has assembled a book in which the story develops smoothly from beginning to end, but in which nevertheless any one of the chapters can be read as a self-contained essay.

The geographer will turn first to the opening chapter, by Professor MacDonald Holmes, "The land and the people"—and will be disappointed. The space available in one chapter is quite inadequate for such a large topic, and the treatment suffers from the inevitable compression. A most interesting map, "Productivity regions of Australia" (p. 8), which summarizes an enormous amount of work, has been so much over-reduced in reproduction that interpretation is very difficult and much of its value is lost. The population distribution map (p. 15) has suffered less in this way, but is still too small for comfort. A series of tables of rainfall and temperature distribution figures is most useful. On the whole it may be said that the more the reader already knows of the geography of Australia the more he will get out of this chapter.

Much of part two, the historical background, is relevant to a study of Australian geography, but Chapter 3, "The triumph of the pastoral economy," by J. M. Ward, and Chapter 4, "The gold rushes and the aftermath," by R. M. Crawford and G. J. James, may perhaps be specially mentioned. The techniques of large-scale pastoralism, the general impetus to production, to population growth, to closer settlement, to the beginnings of wheat growing and to the emergence of the specialized itinerant worker (shearer and harvester) have left their imprint unmistakably on the rural landscape and on the working organization of much of the rural industry of to-day.

Part four, economic and social development, contains much of the stuff of the present economic geography of Australia. Special mention should be made of Burton, "The growth of the Australian economy"; Walker, "Australia and the world economy"; J. G. Crawford, "Primary industries in the economy"; Fitzpatrick, "Secondary industries in the economy"; and Clark, "Tertiary industries in the economy." Crawford has a very useful map (p. 186) of the chief crop and livestock belts of Australia, though like the others it suffers somewhat from excessive reduction, and a series of illuminating graphs of production of various farm commodities.

Part six, Australia and the south-west Pacific, is likely to prove disappointing to geographers because of its very limited scope. "The native peoples," by Professor Elkin, is not a study of the aborigines of Australia and the natives of Australian New Guinea, but merely a review of their treatment by white Australians, and Greenwood's chapter, "Australia's interest in the South Pacific Islands," is largely the story of Australian pressure on the British Government to annex all the islands of the south-west Pacific.

This is a valuable work, a kind of small encyclopaedia of Australia, written by Australian authors, who look at their problem through Australian eyes from inside their own country. Not the least valuable contribution however is the admirable bibliography, selected and annotated by the editor.

The companion volume on New Zealand is yet another to add to the list of symposia that have appeared in the last twenty years. As one of a series "dedicated to the task of mutual understanding among the Allies of the Second World War" it is aimed primarily at the intelligent general public rather than at the professional student, but the student will find much of interest and value in it, particularly perhaps in the quite admirable bibliography, selected, classified and annotated. The authors, with one exception, are New Zealand scholars, though not all are still resident in New Zealand, and their special interests and competence have been harnessed by the editor, Professor Horace Belshaw, to give a smoothly moving account of the many-sided development of the country, conspicuously lacking in the disjointedness that commonly mars a work of this kind.

It is the first two parts that will be most immediately useful to geographers other than the specialists in political geography, for whom part four will have much of interest. The first part is mainly history, but includes a sensitive and balanced chapter on the Maori by Professor Sutherland, who does not shirk the still unsolved problems of Maori development and Maori-Pakeha relations. In part one, too, the editor has set a new precedent for symposia on New Zealand by including a chapter on the geography of the country. The author is Professor Clark of Rutgers University, who had acquired first-hand experience of the country during two years on the staff of the Geography Department in Canterbury University College. The reader who already knows New Zealand pretty intimately will probably want to quarrel with Clark on various minor points, but will enjoy a fresh exposition. Other readers will find it very difficult to form a coherent picture. Essential aid could have been given by the inclusion of a few standard maps (relief, geology or structure, rainfall, temperature, vegetation, and a key map to locations). Their omission was probably not Clark's fault, but it is disastrous, especially since the map of each island in the introduction to the volume is crude in the extreme and the dot maps by Hamilton of sheep and dairy cows are deprived of any connection with the terrain.

In the second part Belshaw's own contribution, "Economic organization," is admirably done. It is meaty and objective, and the soundness of his

appreciation of the economic situation at the end of the war has since been demonstrated by the closeness of the actual developments to his forecast. "The farming industries" by Hamilton is also outstandingly good. Particular mention should be made of his graph (p. 140) of volume of production of various farm products since 1900, which epitomizes the evolution of farming in the period and implies the changes in location as well as in character that have revolutionized New Zealand agriculture.

A final word must be given to Beaglehole's chapter on International and Commonwealth relations. Brilliantly written, perhaps a little cynical, it reviews the changes in public sentiment and in official New Zealand attitude towards its ties with the mother country and, more recently, the responsibilities of full Dominion status. R. O. B.

THE INVASION OF NEW ZEALAND BY PEOPLES, PLANTS AND ANIMALS. By ANDREW HILL CLARK. *New Brunswick: Rutgers University Press*, 1949. $9^{1}/_{2} \times 6^{1}/_{2}$ *inches;* xiv+465 *pages; maps, diagrams and illustrations.* $6

The title of Dr. Clark's book is equally apt for bookstall appeal or as a preliminary analysis of his subject. A century ago the oldest settlement in New Zealand was not yet ten years old and the European population a struggling handful. New Zealand's achievements since then both in agricultural production and social evolution are well known. Few countries can present so compact an example of the effects, good and bad, of the impact of man, his animals and his plants on a virgin soil. Dr. Clark, a young geographer, Canadian by birth and largely American by training, deserves credit for attempting the first survey of this subject within the covers of a single book. He has gathered together a considerable amount of information, mainly from standard sources, some by original inquiry.

Unfortunately he confines himself to the South Island, a limitation not indicated in his title, and his analysis is consequently incomplete. Moreover in two important directions he was inadequately equipped for his task. Two years on the staff of Canterbury College were apparently insufficient for him to understand how fundamentally the problems which faced the New Zealand colonists differed from those of his native continent. Lack of understanding leads to biased judgments. His harsh criticism of agricultural methods in New Zealand are difficult to reconcile with the fact that, per head of the farming community, it is one of the most productive areas in the world. Equally difficult to justify is his irritation at the close British tradition of the country.

The greater part of the book is devoted to the effects—planned and unplanned—of plants and animals introduced by the colonists: on the one hand the development of agricultural and pastoral industries, on the other the ravages of deer, chamois, rabbits, blackberries, gorse and other exotic species. His handling of the latter subject reveals an extreme lack of appreciation of the environmental factors which affect the spread of plant and animal communities. An early chapter contains the statement (based on the outmoded Koeppen system) that the climate of the South Island is of a single type—this of an island where the rainfall varies from 10 to over 150 inches, where the natural vegetation varies from sparse tussock to rain forest of semi-tropical luxuriance, where in some townships winter snow is as rare as it is common in others! Equally unfortunate is his failure to realize the consequence of the absence of indigenous brousing mammals, a major circumstance in determining the extent to which the natural balance of fauna and flora has been upset. His discussion develops into little more than a catalogue of facts—as such however it is fairly

complete. This defect merits consideration apart altogether from the book under review. Studies of subjects of this type by geographers are of the highest importance—no other scientist is potentially so well equipped to assess the wider implications. It would be unreasonable to expect the geographer undertaking such a task to make a detailed biological analysis but it is essential that he should have an understanding of the basic principles of plant and animal ecology. Dr. Clark's book will have fulfilled a useful purpose if it draws attention to the desirability of including these subjects equally with geomorphology and climatology in the training of the geographer. R. S. R.

ISLAND ADMINISTRATION IN THE SOUTH WEST PACIFIC. By CYRIL S. BELSHAW. *London and New York: Royal Institute of International Affairs*, 1950. $8\frac{1}{2} \times 6$ *inches;* viii + 158 *pages; maps.* 12*s* 6*d*

The author of this useful little book dealing with the problems of post-war reconstruction in the Solomon Islands, New Hebrides and New Caledonia writes with a sense of conviction based upon considerable local knowledge, gained both as a peace-time administrator and during his service with the New Zealand forces in the South Pacific.

After a series of introductory chapters in which the geographical, historical and social factors influencing the nature of pre-war administration are analysed, a consideration of the momentous impact of the war, with its prolonged occupation by Allied military forces (1942–46) of the greater part of the area, leads to a review of the new and in many respects chaotic situation which now confronts the British and French colonial authorities. It is gratifying to find, not only in the chapter specifically devoted to the subject but also throughout the book as a whole, that due prominence is given to the importance of geographical conditions in shaping the administration and economic development of the islands in question. In this connection the difficulties of internal, inter-insular and oceanic communications are discussed and the author examines in some detail the effect of these on the translation of formulated policy into practical administration on the spot.

It comes as something of a surprise to realize that the effects of the Allied occupation of these British and French possessions were little, if at all, less revolutionary than those resulting from the enemy occupation of the colonial lands farther north. The two experiences were, of course, entirely different and in the islands held by the Allies (primarily, in this case, the Americans) the native suffered none of the shortages or hardships everywhere associated with Co-prosperity. On the contrary "he saw fabulous wealth in the form of industrially-prepared food and mechanical equipment such as he had never dreamed of. . . . It was treated lightly by its apparent owners, who threw away large quantities in dumps and who gave it away either free or in return for curios, shells and fruit, with little or no thought of price."

One consequence of such experiences extending over several years has been drastically to transform the scale of values, both economic and social, in what were hitherto unsophisticated and more or less docile communities. To-day the indigenous population is no longer content with the standards of the past, while, owing to the relatively limited resources of the islands, little scope exists within the traditional pattern of the plantation and mining economy for a rapid improvement in material well-being. From the purely local point of view it would appear that the solution must be sought mainly in a much greater development of native peasant agriculture, and Mr. Belshaw makes a number of useful suggestions along these lines. But, as he rightly concludes, the problems affecting these islands cannot be solved merely by such means:

"Perhaps the South Pacific Commission, and the growing political restiveness of the people themselves, will ultimately bring administrations to the view that tolerance and legal justice are not enough; and that a forthright programme leading without delay to the establishment of social and economic responsibility is essential." C. A. F.

THE *KON-TIKI* EXPEDITION: by raft across the South Seas. By THOR HEYERDAHL. *London: Allen and Unwin*, 1950. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 235 pages; illustrations.* 12*s* 6*d*

The story of the raft *Kon-Tiki's* voyage across the Pacific is already well known. Fellows of the Society who saw the film that was taken on board will remember its strangeness and the remarkable adventure which it showed so well. The book tells this story more fully and even better than the film.

In the course of archaeological work undertaken before the war, the author had evolved a theory to account for the Polynesian race and the strange monuments such as are found on Easter Island. He believed that the customs and traditions of the people linked them with South America and not with Asia. The physical difficulty of the Pacific crossing for a people that had no boats or ships was the chief argument against it; but it had been handed down in the traditions of the Polynesians that their ancestors had arrived from the eastward on rafts. Mr. Heyerdahl set himself to discover if such a voyage could in fact be made.

From a Sailor's Home in New York, with no funds and all scientific opinion against him, he set out to organize the expedition. Five former companions in the Norwegian resistance movement joined him and within a few months they were hewing balsa trees in the forests of Ecuador. Floating the great logs down to the coast, they started to build their raft in the chief Naval dockyard of Peru where they met with much assistance, but little optimism, from professional seamen. Not sailors themselves, they could only listen to forebodings of what would happen to the raft if it were built in the way they intended; however Mr. Heyerdahl stuck to the teaching of the ancients. He built his raft exactly as they had done many centuries before and eventually, with the head of the old god Kon-Tiki painted on the sail, they were towed to sea.

Fortunately the ancients were right. The ropes did not chafe through but bit deep grooves into the soft balsa wood; the seas did not sweep them off the raft but poured through between the logs. Urged on by the current and the south-east Trades, the raft carried them slowly across 4000 miles of ocean from Peru to the Polynesian islands. There were times of stress when they feared that the *Kon-Tiki* would capsize, there were times when it was almost impossible to steer with the great oar over the stern, there were attacks by great fish and finally they were wrecked on a coral reef. The voyage was truly an exciting one; all the time strange things were happening, some of which the author cannot account for, and always there was danger. And when at last the raft was cast upon the reef the crew were lucky to escape with their lives. Much of the success of the venture must be put down to the happy spirit and great physical strength of these men from Norway who, like their forerunners the bearded white men from Peru, were at home on the sea.

The author makes no claim to have proved his theory of Polynesian migration and only says that he has shown that such voyages could have been made. Most who read his book will feel that they were. This voyage ranks among the classic small craft voyages of the world and seamen will probably agree that it should be classed with those of Bligh, Slocum and Voss; the name *Kon-Tiki* will be remembered with *Spray* and *Tilikum*. It was a fine achievement and the book is worthy of it. A. C.

PHYSICAL GEOGRAPHY

GLACIERS AND CLIMATE: geophysical and geomorphological essays dedicated to HANS W:SON AHLMANN. (*Geografiska Annaler* 1949, Häfte 1 and 2). *Stockholm, Svenska Sällskapet för Antropologi och Geografi*, 1949. 10×7 *inches; 383 pages; maps, diagrams and illustrations*

This volume of upwards of thirty contributions from eleven countries is dedicated to Hans W:son Ahlmann on his sixtieth birthday. It is a worthy tribute by the Swedish Society of Anthropology and Geography and associated with it are the names of more than 500 of his colleagues, friends and pupils. The editorial committee, headed by Carl M:son Mannerfelt, included the Director of the Royal Geographical Society.

Most glaciologists develop from an initial interest in snow and ice, or in the morphology of glaciated terrain. For Ahlmann the step from the latter interest to the problems of the economy and movement of glaciers, and the climatic factors influencing their advance and recession, came early. He was a pioneer in realizing the necessity for collaboration in widespread systematic observation and his organization of expeditions in the past twenty years, culminating in the Norwegian-British-Swedish Antarctic Expedition of 1949–52, display the hand of the master designer.

The range of the studies here presented fully reflects the inspiring influence of Ahlmann's own work. As might be expected, a substantial number deal with various aspects of post-glacial climatic fluctuation, especially the fluctuation of the present century. The effects of glacier shrinkage on hydro-electric power, on the rise in cultivation level and the northward migration of its limits, and on improved communications in high latitudes, give the study of these changes a more than academic interest. J. Eythorrsen discusses the temperature rise in Iceland and its consequences, while I. Hustich (Finland) contributes an article on the correlation between the growth of plants and the recent climatic fluctuation. In high latitudes both plants and animals have responded favourably to the rise in temperature with a consequential northward shift of the forest-tundra zone; in low latitudes it is the precipitation factor which controls growth, and a deterioration appears to be associated with the shift of the steppe-forest zone towards the equator. The large scale reversal of these trends in temperature and precipitation control is demonstrated by E. Nilsson's discussion of the Pluvials of East Africa and their correlation with the glacial phases of the northern hemisphere.

This similarity between short term small scale fluctuations and the longer and larger climatic fluctuations within the Pleistocene is but one of the points emphasized by H. C. Willett, in an important contribution which summarizes the conclusions reached in an investigation undertaken for the U.S. Weather Bureau and Massachusetts Institute of Technology extended forecasting project. He considers that the still larger climatic fluctuations of remote geological times, represented by continental glaciation on a scale comparable with that of the Pleistocene, fall into a similar pattern in being essentially zonal in character. He suggests variation in the ultra-violet component of solar radiation, such as is associated with sunspot variability, as their cause. From a study of sea temperatures and salinity, B. Helland-Hansen also concludes that oceanic and atmospheric variation have a common cause in circulation changes that are due to variations in the energy received from the sun. A. Defant (Austria), using data based on convection processes in the upper layers of polar shelf seas, infers that the date of ice formation can be predicted. A. Ångström

(Sweden) discusses atmospheric circulation, climatic variation and continentality in general; the changes in the general circulation associated with the recent climatic variation are ably analysed by S. Petterssen (Norway) who gives an admirable summary of these effects.

A consideration of synoptic conditions favourable to snow precipitation, in J. Leighly's paper "Continentality and glaciation," leads him to a modification of Flint's reconstruction of the wind systems associated with the Pleistocene ice sheets of North America. West winds are replaced as snow producers by injections of tropical maritime air from the south in winter. Starting from a discussion of the altitude of "permanent" snowbeds on Ben Nevis in relation to the firn line in western Europe, Professor Manley contributes a well reasoned basis for estimating the variation of the snow line in Britain in post-glacial time, with particular attention to the recrudescence of glaciation that is associated with the Allerød oscillation.

In a critical approach to the hypothesis of "extrusion flow," W. Vaughan Lewis develops rotational slipping as an alternative explanation in glacier movement and cirque formation. V. Schytt, of the Kebnekajse Glaciological Research Station, makes a significant contribution on the importance of the refreezing of melt water on the surface of glacier ice. Meteorological factors affecting the shrinkage of the Kårsa glacier in Swedish Lapland are the subject of a careful study by C. C. Wallén (Sweden). W. Werenskiold (Norway) gives a preliminary account of the prolonged detailed studies of Jotunheim glaciers, and C. Troll and K. Wien (Germany) discuss the Lewis glacier on Mt. Kenya and the meteorological conditions which account for the extension of ice to lower altitudes on the west than on the east of the mountain. Seligman contributes an attractive historical essay on "Research on glacier flow," tracing the growth of ideas from the early misconceptions of Alpine travellers to the present era of glaciological research.

Professor Flint gives a preliminary account of extensive Pleistocene drainage diversions in South Dakota and R. Blanchard (France) discuss the role of dead ice in the formation of Lake Témiscamingue, while geomorphological problems that are distinctively "post-glacial" in character are represented by a study, by J. Sölch, of the influence of regional and local factors in the formation of alluvial cones in the Alps, A Schou (Denmark) contributes a well illustrated analysis of the development of coastal cliffs in Danish glacial deposits; variations in cliff-form in these soft unconsolidated deposits are regarded by him as essentially stages in shore-line simplification and not as phases of emergence and submergence.

Eminent men of the calibre of C. E. P. Brooks, E. de Martonne, H. Baulig and H. O. Sverdrup pay their tribute in short, thought-provoking articles dealing critically with fundamental ideas. Other contributions not less interesting, which limitations of space forbid more than reference by name, are by G. J. Klein (Canada), G. H. Liljequist (Sweden), H. Landsberg (U.S.A.), C. M:son Mannerfelt, S. Thorarinsson (Iceland), G. Lundqvist (Sweden), A. Noe-Nygaard (Denmark) and F. Hjulström (Sweden).

The sponsors of this complimentary volume, the editors, and the authors of the essays are all to be heartily congratulated on a fine achievement. As a token of world-wide appreciation it is worthy of its high purpose and it will, not least by the great scientific importance of the contributions, gladden the heart of an outstanding geographer and a great European. S. E. H.

MATHMATICAL GEOGRAPHY

THE STORY OF MAPS. By LLOYD A. BROWN. *Boston: Little Brown and Co.*, 1949. $10\frac{1}{2} \times 8$ *inches;* xix+397 *pages; maps, diagrams and illustrations.* $7.50

This is an excellent and most readable book. Its content goes far beyond what is indicated in the title for it is not so much the story of maps as the story of the measurement of the earth; the earliest speculations as to its spherical form and size, the decline and renaissance of geographical ideas, the development of astronomical navigation and the growth of modern geodesy. American interest in maps appears to be rather a new thing, fostered by the war as the author says, and maps are indeed the central and recurrent theme. It is the wider and less familiar subject it develops that should recommend it to English readers. There can be no doubt of the author's erudition and his notes and the extensive bibliography will be welcomed by students. It is remarkable that Mr. Brown should have burdened his text so little with the technicalities of mathematics and astronomy, for he has succeeded in explaining what he describes and he touches on much that is unfamiliar to the general reader. His style is easy and discursive, and he deals as much with personalities as with theories. The only section the present reviewer found dull was the dozen or so pages which set out the detailed cartographic achievements of the nineteenth and twentieth centuries; but this is certainly information it would not be easy to find elsewhere.

The first three chapters reveal the extent of geographical knowledge in the Classical world and trace the early growth of geographical ideas, the fourth deals rather discursively with the myths of the Middle Ages. Two chapters, "Charts and the haven-finding art" and "The map and chart trade," bring the story up to the end of the seventeenth century, the latter containing much interesting matter on early processes of reproduction and the personalities of the great cartographers of the Netherlands. Best of all perhaps are the next two chapters, "The latitude" and "The longitude," which besides recounting the more familiar topics of John Harrison and his chronometers, Hadley's sextant and the foundation of the Royal Observatory, place in their proper perspective the contemporary achievements of the French savants of the Académie Royale. The remaining chapters deal with the inauguration of precise surveys, by the Cassinis in France and by General Roy in England, the determination of the figure of the earth and the great extension of topographical survey throughout the world.

'The story of maps' is handsomely printed and produced, with a wealth of well chosen and attractive illustrations. There are some misprints. F. G.

GENERAL

THE STUDY OF GEOGRAPHY. By J. M. MOGEY. (Home University Library.) *Oxford: University Press*, 1950. $6\frac{3}{4} \times 4\frac{3}{4}$ *inches;* iv+164 *pages; maps and diagrams.* 5s

Dr. Mogey hails from the University of Belfast and his vigorous and spirited gallop over the wide field of geography cannot but turn the minds of the older among us to Dr. Marion Newbigin's thoughtful and thought-provoking 'Modern geography' in this same series of publications. But times have changed, and we are now in the third generation of writers from the pioneers. Yet the old dilemma still faces us. As Dr. Mogey rightly says: "One of the major

functions of geography is to direct attention to the inter-relationships of phenomena affecting the surface of the earth, not omitting man." But who is sufficient for these things? For the mastering and marrying of half a dozen or more distinct disciplines? It would be easy to find half a dozen sticks to belabour Dr. Mogey with. His few incautious words on Eratosthenes and Mercator for example, make it clear that he has not grasped the barest elements of mathematical geography, while the re-introduction of the vast low pressure over the Siberian plains will draw a heart-cry from the climatologist. So, too, one might say that the author's geomorphology is old-fashioned, his political history naïve, his knowledge of economic history completely lacking. But this would be, in part at least, unfair, for immense compression and very wise selection are needed for a book of this character. Yet the doubt remains whether any worth while human geography can be developed in relation to a merely superficial grasp of physical and historical geography. And when Dr. Mogey gives us a fragment of his own careful and really valuable field study in rural Ulster, he appears to play it down as merely an academic exercise. Yet if only such studies were multiplied and assembled for comparative examination (and were carried out according to a technique agreed among human geographers) there is little doubt that a much more mature discussion of determinism and "possibilism" could be entered upon than any that Dr. Mogey outlines or hints at here. Young geographers should however console themselves with the recollection that everyone who declines to accept the strict trespass line around "subjects" is liable to burn his fingers. When the history of science is to be written, the historians say that the scientists make nonsense of it because of their ignorance of the techniques and content of history. Equally the scientists say the historians make nonsense of it because they know no science. The debate continues.

But Dr. Mogey cannot escape criticism on two counts. He says correctly that the map is the principal tool of the geographer, but anyone looking at the maps in this volume will agree that he keeps his tools in a disgraceful state. Of course the publisher is largely to blame, but if we are willing to overlook the human geographer's shaky "physical basis" we must at least expect his "tools" to be clean and sharp. In the second place, Dr. Mogey writes very carelessly: again and again his vocabulary and syntax are at fault, and the old-fashioned publisher's or printer's reader who would have called the author sharply to heel appears to have vanished. What are we to make of "His (man's) mines sunk their shafts for ores a mile deep in the crust and his oil-wells ground deeper and deeper yet"? Or again: "This dynamic impulse is more than mere cause and effect, it is a complex entity affecting all lands and all peoples," both sentences on the same page. Dr. Mogey can hold the reader's attention both by his subject matter and his point of view; why not also by his style?

One puzzle remains. "The milk of animals (we are told) relieved women of one of their heaviest burdens. Milk produced children with no limit to their numbers . . ." What was the burden thus removed? A week of pondering the matter has brought no rational solution. E. G. R. T.

THE SOCIETY'S NEWS

THE NEW COUNCIL OF THE SOCIETY

Among the elections to the Council made at the Annual General Meeting on June 19 are those of Sir Raymond Priestley as Vice-President and of two other members, Dr. G. E. R. Deacon and Mr. H. W. Tilman, who have not previously served on the Council.

Sir Raymond Priestley, who was a member of the Council from 1942 to 1945, is Principal and Vice-Chancellor of Birmingham University and was with Shackleton on the *Nimrod* Antarctic expedition of 1907–9 and on Scott's Antarctic expedition of 1910–13. He is a distinguished authority on glaciology. Dr. G. E. R. Deacon, F.R.S., is Senior Principal Scientific Officer in the Royal Naval Scientific Service and served as an oceanographer in R.R.S. *William Scoresby* and *Discovery II* between 1927 and 1939; he was awarded the Polar Medal in 1942. Mr. H. W. Tilman, awarded the D.S.O. in the last war, is well known for his many expeditions to the Himalayas and to Kilimanjaro, Ruwenzori and Mount Kenya. He was leader of the 1938 Mount Everest expedition and is now leading an expedition, supported by the Society, to central Nepal.

Professor C. B. Fawcett of University College, London, a Vice-President of the Society, who is at present a visiting Professor at the Clark Graduate School of Geography, Worcester, Mass., has received the honorary degree of Doctor of Science from Clark University.

THE INTERNATIONAL EXPEDITION TO QUEEN MAUD LAND

A further meeting of the International Committee for the expedition was held in Oslo in May last. Plans for 1950–51 were discussed and it was agreed that the principle objective, apart from supplying the base at Maudheim, would be to carry out a programme of aerial photography, approximately between longitude 20° W. and 15° E. This would be done by Norwegian aircraft supplied by the Wideröe Aviation Company of Oslo. Its main aims would be to chart the location of the ice barrier; to photograph the western unexplored areas of Queen Maud Land; to map from the air an area as extensive as ground control by sledge parties would permit; and to obtain photographs of the mountain regions to the east of Maudheim for comparison with those taken by the German Expedition of 1938–39. These would be especially valuable for the study of glacier recession.

The aircraft will probably be taken south on a factory ship from Norway. The Expedition ship itself, the *Norsel*, will again be available and is likely to leave Oslo about 20 November, 1950 and call at South Georgia to take up additional dogs which have been maintained there for the last six months. It is hoped that the first air operations will start in the first week of January 1951.

It is probable the Professor Sverdrup, Director of the Norwegian Polar Institute, Oslo, and chief organizer of the Expedition, will go south with the Expedition ship, and return towards the middle of 1951. It has also been agreed that one or possibly two British scientists will be included in the ship's party.

THE RECORD

THE TORNADO IN BUCKINGHAMSHIRE

From the violent thunderstorm which swept across London at the unusually early hour of between 9 and 10 a.m., B.S.T., on Sunday 21 May, 1950 it was a fair presumption that the atmospheric conditions over south-eastern England were exceptionally unstable. The weather chart which appeared in *The Times* next morning indicated that on the previous day the country lay in a warm humid southerly air current, along a "cold front" or wind-shift line within the south-eastern sector of a barometric depression. This is the usual meteorological setting for the genesis of storms of the tornado type when they do occur, in England as well as in the United States. The newspapers of May 22 reported that between 5 and 6 p.m., B.S.T., on Sunday, a tornado had devastated the eastern side of Buckinghamshire with contiguous strips of Hertfordshire and Bedfordshire along a north-easterly track (the usual direction) some 20 miles long between Wendover, beneath the Chiltern scarp, and Linslade near Leighton Buzzard, and on the average about 50 yards wide. At Wendover many roofs were badly damaged, at Halton R.A.F. camp, where a fatality is said to have occurred, the roof of the power station was wrenched off and carried to Aston Clinton 2 miles away and at Linslade, where motor cars were lifted into the air, the wrecking of many homes together with the flooding of rooms by torrential rain and hail caused much distress though, apparently, no fatalities. According to more recent information,[1] preliminary to a fuller investigation being made by the Dunstable branch of the Meteorological Office, the main tornado extended along a track from the Chilterns to the Norfolk Coast (about 100 miles) and was attended by two other vortices of short track near Bedford.

Shortly after the event the writer of this note visited the Buckinghamshire end of the affected area to learn what he could about the storm, and returned with no doubt that a whirlwind answering fully to the conventional description of a tornado had in fact originated a mile or two behind the escarpment of the Chiltern Hills. Several persons said they saw the funnel-shaped cloud moving across the countryside and a lad questioned in a secluded fold of the Chilterns northward of Chesham had noticed the spout writhing and dangling in the sky, looking very black at the top but of a lighter greenish hue lower down. Those who experienced the disturbance at close quarters saw a dense whirl of dust sounding like the roar of an express train. But the most impressive accounts from the country people related to the sudden onset of the darkness of night with very severe thunder and lightning, hail lying inches deep and bringing down all the telegraph wires, and to the subsequent sight of clouds "spinning round like a top" with scores of tree-tops being snapped off to hurtle through the air.

At Wendover a number of uprooted trees in a large paddock and orchard indicated both the rotary and forward motion of the vortex inasmuch as while trunks were lying prone in all directions the majority were pointing northward. As the tornado moved along its track to the north-north-east, it rose and fell in characteristic fashion leaving intervals of ground undisturbed. So typically narrow moreover was the path of destruction, that when on May 30 the writer walked across the adjacent part of the Vale of Aylesbury, seeing hedgerow and spinney a mass of foaming hawthorn and the great elms looming out through a

[1] *Weather* 5 (1950) 254.

light haze all intact, there was little in the scene to suggest the trail of lightning and tempest close by.

Although hardly on the scale of violence common in America, the tornado was a good specimen for this country and probably the worst since the Welsh tornado of 27 October 1913.[1] The small loss of life has been generally attributed to the fact that few persons were out of doors that stormy evening. It may be noted that on the afternoon of 21 October 1638, a tornado, preceded like the recent one in Buckinghamshire by intense darkness with devastating hail, shattered the church of Widecombe-in-the-Moor in Devon, killing or injuring by the combined effects of lightning and whirlwind upwards of sixty of the congregation at a service. The calamity which has naturally left its mark on the folklore of Devonshire has been described by the writer from a contemporary tract.[2] L. C. W. B

A CONFERENCE ON GLACIOLOGICAL RESEARCH

The Library has received a cyclostyled copy of the proceedings of the Conference on Glaciological Research held in New York in January 1949, under the auspices of the Arctic Institute of North America and the American Geographical Society.

Dr. Henri Bader, formerly of the Weissfluhjoch Research Station, reviewed modern trends in European glaciology, and emphasized the problems of glacier motion and the transformation of firn into ice. He advocated the concentration of a group of workers on some chosen glacier that they could keep under continuous observation, or at least observe from year to year. Dr. Walter H. Bucher, President of the American Geophysical Union, pointed out the close analogies between glacier structures and the geological structures of folded ranges; similar optical and statistical methods are applicable to the crystal fabric in ice and the petrology of metamorphic rocks; the thrusts and folds that are revealed by the wastage of glaciers should be mapped by the methods employed by field geologists. Dr. Dyson, professor of geology at Lafayette College, referred to the work now being done in the Glacier National Park, where the recession accompanying the present climatic fluctuation may well enable the observers to witness the total disappearance of a glacier, and perhaps its later rebirth. Other speakers outlined current American field projects in Baffin Land, Alaska and the Andes.

The second part of the conference was largely concerned with techniques and with the relation of glaciological studies in America to the universities and the military services. There were some interesting comments on the efficiency of field work and the extent to which the energies of specialists are absorbed in "housekeeping" and travel.

UNIVERSITY NEWS

KING'S COLLEGE, NEWCASTLE-UPON-TYNE

The maintenance of the numerical strength of the Honours School (over 60) and the numbers of Pass, Town and Country Planning, and Commerce students reading Geography has made life very full for the teaching staff of the Department. New and enlarged premises, to be occupied until the final home of the Department is provided in keeping with the overall development scheme of the College, have given much needed and welcome elbow room. It has been possible to accommodate the Reader in Surveying (Commander D. H. Fryer,

[1] *M. O. Geophys, Memo No.* 11.
[2] *Weather* 1 (1946) 123.

R.N.) and the Reader in Anthropology (Dr. S. F. Nadel), and the close working relations with both have continued to be of great value. A Joint Honours degree in Geography and Anthropology has been introduced and one records with a mixture of pleasure and regret that Dr. Nadel will be leaving the College this summer to take up his professorial duties at Canberra. Field work continues to be treated as an important part of our geographical work and during the Easter vacation of 1950 five separate field weeks were organized.

Research is much to the forefront in the life of the Department. Mr. Conzen's work on settlement geography is well known, Mr. House has been engaged with population studies and Mr. Mather is completing his study of the migration of West African labour. Mr. Anson has been absorbed in cartographical problems and makes most effective contributions to the whole of the research undertaken. Professor Daysh has been supervising the work of the five researchers attached to the Northern Industrial Group and the North East Development Association and is especially concerned with the investigation (financed by the Nuffield Foundation) into the conditions of West Durham. The results of work on physical land classification and migration problems are about to be published while, with the aid of Miss E. M. Watson, a new Survey of Cumberland has just been completed and this will be published in the summer of 1950. Professor Daysh has also been occupied with the secretarial work of the Commission on Ports set up by the International Geographic Union. In addition to the researchers attached to the regional organizations, there are five postgraduate research students in the Department, two from Egypt, one from Germany and one from the University of London, together with one of our own graduates. The research undertaken embraces micro-climatology, cartographical problems, industrial location, agricultural geography and the historical geography of trade routes.

The visit of the British Association to Newcastle in 1949 occupied the attention of members of the staff for some weeks ahead. Mr. Conzen acted as Local Secretary to Section E and together with Mr. House and Mr. Mather contributed to the work of the Section. Mr. Anson rendered most valuable assistance in the preparations for excursions while the research students played their part very nobly. The pretty regular stream of visitors to the North East suggests that the all too commonly held belief in our isolation is far from true. Mr. Wordie delivered the annual Tyneside Geographical Society lecture in 1949 and Professor Jean Gottmann was a most welcome visitor from Paris to give it in 1950. Scandinavia, Germany, Holland, France and Australia have been amongst the overseas areas from which University teachers and students have come; perhaps especially to study the problems of the North East Coast and Cumberland and to learn of the liaison which the Department has with official and unofficial bodies concerned with economic and physical planning problems. Members of the staff have visited several European countries and Professor Daysh, although unable to accept an invitation to visit Egypt in February 1950, expects to go there for two or three months early in 1951. The Department contributes in many ways to the work of the Durham University Exploration Society and is happy to provide space for its equipment and files, together with those of its constituent body, the King's College Exploration Club.

Finally, a brief reference to posts obtained by graduates. Several have been appointed to undertake research for planning in central and local government. The Civil Service and the Colonial Survey have absorbed others and two have obtained University appointments, one overseas. Teaching and full time research into regional problems may be included in the list of major avenues of employment over the recent period.

G. H. J. D

GEOGRAPHY IN PAKISTAN

In pre-partition India geography was a comparatively new University subject and only Aligarh and Calcutta had well established post-graduate departments with research facilities; Lahore (Punjab), Benares, Agra and Allahabad had started post-graduate teaching hardly a year before the division of the country. Pakistan inherited only two established Universities, Punjab (Lahore) and Dacca (east Pakistan), while a third Sind (Karachi), had then just been founded and the new Peshewar University did not then exist.

Fortunately, west Pakistan retained the old established and well known Punjab University at Lahore. In 1945 Dr. K. S. Ahmad, a former lecturer and Reader at Aligarh who had been a research scholar in London, was appointed head of the newly inaugurated department of geography. By his keenness, enthusiasm and scholarship he has succeeded in putting geography on its feet in the only University of Pakistan where post-graduate courses in the subject are taught. Dr. Ahmad's interests lie in cartography, geomorphology and land use problems and he has a number of papers and a couple of books to his credit. He has recently been elected President of the newly founded All-Pakistan Geographical Society, which is being affiliated to the International Geographical Union. Geography is now taught in several of the colleges at Lahore and at a few other towns, and about a dozen students have obtained their M.A. degree each year. A woman lecturer of this department has recently been awarded a research scholarship by the Government of Pakistan to study in the United Kingdom. At Karachi, Dr. M. B. Pithawalla who is well known for his several monographs on Sind is doing his best to obtain a proper recognition for geography as a university subject.

In east Pakistan geography was only a secondary school subject in pre-partition days. But soon after the establishment of Pakistan, B.A. and B.SC. degree courses were introduced at the University and Mr. Nafis Ahmad, who formerly taught at Islamia College and Calcutta University, was appointed Reader and Head of the Department. About forty students including four women are now taking the degree courses. Geography has been given due recognition by its inclusion in both the Science and Arts Faculties and the University has agreed to open M.A. and M.SC. classes as soon as possible. Mr. Ahmad is interested in economic geography, the history of geographical science and problems of land use in east Pakistan. His two recent books, 'The basis of Pakistan,' and 'Muslim contribution to geography,' attracted considerable notice and he has written several papers on east Pakistan's economic development.

Geography has a promising future in Pakistan, for this new and comparatively undeveloped country needs trained geographers not only in diplomatic and consular assignments and various branches of the civil service, but also in industrial management, transport and town planning and in the armed services of the nation. Above all there are many problems in the demographic, hydrographic and regional fields inviting the immediate attention of trained geographers. Teaching posts in schools and colleges will also absorb many graduates for several years to come.

N. A.

THE SOCIETY'S GEOGRAPHICAL ESSAY PRIZE

The award of the Geographical Essay Prize for 1950 to Mr. J. R. Sparey, with Mr. D. M. Hill as *proxime accessit*, was announced in the last issue of the *Journal*.

Mr. Sparey's regional survey of the parish of Titchfield in Hampshire deals with a small area chosen by him to illustrate in detail the interaction of many

geographical factors. The parish has an area of about 5¼ square miles and had in 1931 a population of 2336 persons. The geology is described and though it exhibits few striking features it is shown to determine the distribution of soil types and, consequently, the utilization of the land. The agricultural pattern is a varied one of mixed farming and market gardening, dominated by the river meadows of the Meon valley and the arable of the drier slopes, with woodland and coppice on the upland. The land utilization map of 1932 is discussed and also the changes revealed by the author's resurvey in 1948. The long and quiet history of this English parish is briefly traced from the Jutish settlement, which gave its name to the river Meon, through its assessment in the Domesday Book and its representation in the County and Estate maps of the sixteenth and seventeenth centuries and in Ordnance Surveys since 1810. Titchfield ceased to be a seaport when the Earl of Southampton reclaimed the Meon estuary in the seventeenth century, its iron works are extinct and, though it still possesses a tannery, the new housing estate would appear to cater for those who travel daily to work in Portsmouth and Southampton.

The numerous maps and photographs include ten coloured sheets on the scale of 2½ inches to the mile to demonstrate the distributions that are discussed. There are appendices on soils and on statistics relating to meteorology and transport facilities. This essay, which has been placed in the Society's Library, may usefully be studied by anyone who contemplates a similar survey.

Mr. Hill writes on patterns of rural settlement in Japan. The prefecture of Yamaguchi lies on the shores of the Inland Sea and its agricultural settlements are largely confined to the alluvial valley flats of a hilly region. Cooperative effort between farmers is a feature which strongly influences the social organization where it has not been undermined by modern economic changes. Village sites are for the most part restricted to the islands of older alluvium standing above the rice plains and small related house clusters are more characteristic of the settlement pattern than either the dispersed or the nucleated types of the text books. The pattern of coastal settlements is typically linear, the villages being situated between the sea and a small rice plain, for their inhabitants are both farmers and fishermen. The tourist industry and anthracite mining have naturally produced more specialized types of settlement. This essay has also been placed in the Society's Library.

THE *TOWN PLANNING REVIEW*

It would be reasonable for readers of this *Journal* to assume the practice of Town and Country Planning to be essentially applied geography. It would be realized in making such an assumption that the studies of many related disciplines are relevant to the main theme and that for many particular problems one or more of these may assume a greater significance than the specifically geographical aspects. In practice however such is clearly not the case, for the administrative, legal and architectural aspects of Town and Country Planning have dominated current practice in the United Kingdom and elsewhere.

A very refreshing contrast to this state of affairs and a hopeful augury of a saner outlook is provided by the *Town Planning Review*, published by the University Press of Liverpool and edited in that University's School of Civic Design. An inspection of recent articles in this *Review* reveals a praiseworthy attempt to cover the full and proper field of Town and Country Planning. The April number includes a stimulating article by Professor Gordon Childe on "The urban revolution," which reveals how the lessons of archaeology can be applied to Planning, and an article on the new Ordnance Survey 1/25,000 maps by Mr. F. J. Monkhouse. It also appropriately contains an article by

Wilfred Smith, the recently appointed Professor of Geography at Liverpool University, on "The location of manufacturing industry in Great Britain." Professor Smith is primarily concerned to emphasize that industries must be classified according to their degree of mobility. At the outset he introduces the salutary warning that it is the congerie of "light industries," which are mobile with regard to materials, that are especially attractive to those formulating development plans. The implication is that they try to shut their eyes to the vast number of immobile or only partly mobile industries upon whose efficient functioning so much of our welfare depends.

Professor Smith very deftly brings together the not unfamiliar facts of economics and geography which govern the manufacturer's choice of location and site, and puts them in a form suitable for easy digestion by the busy planning officer and for the education of his juniors. One is struck by the fact that the contributions to the *Town Planning Review*, of which this is but one example, are at once more practical and more intelligible to those being planned for than the so often dilettante and even incomprehensible articles on planning to be found in architectural journals throughout the Western world. Fortunately the *Town Planning Review* is able to share one blessing found in architect's journals, a generous provision of half-tone blocks; accompanying Wilfred Smith's paper are no less than 28 excellent air photographs, including one stereoscopic pair, and one accompanied by a map of the corresponding area. It is to be hoped that as many as possible will recognize the valuable forum provided by this *Review* for making contributions to Town and Country Planning in its widest and proper sense. F. H. W. G.

AUSTRIAN GEOGRAPHERS

The contribution of Austria to cartographical and geographical progress is described in considerable detail by Hugo Hassinger in 'Osterreichs Anteil an der Erforschung der Erde' (Wien: A. Holzhausen, 1949). Geographical position militated against Austrians taking a prominent part in the great maritime discoveries, but the astronomical school of Vienna contributed to the scientific development of navigation in the period of J. von Gmunden and Regiomontanus. Other geographers can be claimed as Austrians who are not generally thought of as such, for example, Martin Waldseemüller. Professor Hassinger also draws attention to recent research which has shown that the modern cartography of Central Europe began in the early fifteenth century, before the work of Cardinal Nicholaus Cusanus, and that Austria can claim a share in this development. Though the maps themselves have not survived, it is possible to reconstruct them from lists of coordinates. There were two main types: one ascribed to a Fridericus of Regensburg, dated at *c.* 1424, and uninfluenced by Ptolemy; the second ascribed to Reinhard of Reichenbach, *c.* 1442, and including two hundred place names.

From its relation to south-east Europe, and particularly the Danube, Austria is on a main axis of communication and this, in conjunction with its historical role, has offered opportunities of travel to many of her citizens, from the Crusaders onwards: their achievements are carefully chronicled here, and their fields of work indicated on outline maps of the continents. What can claim to be the first geographical periodical, the *Kosmographischen Nachrichten* was published in Nurnberg and Vienna in 1748. It is difficult to treat of the development of geography in one country without reference to progress elsewhere, and in the case of Austria it is often entwined with progress in Germany, but the author generally succeeds in keeping the narrative in perspective, and in showing that modern Austrian geography has a character of its own. G. R. C.

THE THEORY OF LANDSCHAFTEN

A careful analysis of the theory of the "Geographische Landschaft" as the central theme in geography is contributed by Professor Carl Troll to *Studium Generale*, April 1950, a new German periodical devoted to the unity of the sciences. The essay, founded principally on recent German work, includes a discussion on nomenclature. The theme is worked out systematically as a conception of regional and comparative geography, and most aspects are brought within the classification.

In German *Landschaft* has two meanings, the older signifying a region or district, and sometimes the dwellers therein; the second, which came into circulation in the Renaissance, corresponds to the English "landscape." This word has never in English had the earlier signification, and its use, as in "humanized landscape" for "Kulturlandschaft," is open to objection; "region" seems the nearest equivalent.

Landschaftskunde, since it is concerned with the synthesis of geographical elements and with spatial units, is held to be in the logical development of geographical thought. The "region" is a *Ganzheit*, "a complicated association of very different integral objects"; it is more than a mere sum of its individual elements, but not a biological organism. The subsidiary themes are concerned with the morphology of the region (delimitation, structure); physiology (functions of the elements, their interaction, human ecology); typology (establishment of ideal or typical regions, dependent upon the point of view, geomorphological, physical, climatological, etc.); chronology (reconstruction of past regions, introducing first the conception of the *Urlandschaft* and then changes due to human occupation) and finally development and protection, which bring in nature reserves and regional planning.

The process of determining the regions begins with the recognition of world climatic belts, divided continentally, and then involves further subdivision from considerations of build, relief, soil and hydrology. This process raises the question of the ultimate size of these regions. Where is this subdivision to stop? Professor Troll holds that eventually a small unit is reached which it is impracticable to subdivide and which is found occurring in association with others to form a *Landschaft*. These he regards as the *Bausteine* of the region. In the example he quotes from the Bergische Land, these *Bausteine* include loam-covered remnants of the high surface, rocky or stony valley slopes, less steep slopes with loam, river terraces, flood plains, etc. With the example of the ecologists in mind, he calls these small units *Ökotop* (cf. Tansley's 'ecotope') or cells. In each *Landschaft* a limited number of these occur in characteristic associations with a clear distribution pattern. Within each cell, the ruling consideration is the close relationships between climate, soil, vegetation and fauna, displayed in the microclimates, soil profiles, ground water conditions, etc. Destruction of the plant cover will upset the whole balance with disastrous results. Over one region there will be changes in soil and climate resulting, for example, from topography, exposure to winds, insolation, etc. These may be considered as local types, mid-way between micro- and macro-climates. These *Ökotop* are harmonious structures which can only be understood as a whole, and from the relations of their composite elements. The *Landschaft* which they compose cannot be delimited by drawing lines mechanically on a map. The cultural element in the *Landschaft* also follows definite laws, and understanding of the whole regional structure of the earth requires appreciation of the interplay of the cultural with the mechanical and biological elements. The cultural elements are determined by the cultural kingdom in which the region falls, based on the general form of land utilization (*e.g.* plough cultivation,

pastoralism, plantation culture, mining); and the degree of cultural transformation of the surface, roughly expressed by the density of population. According to F. Jaeger's classification there are fourteen such "kingdoms," the form of state sovereignty being also a factor considered.

Where the exploitation is adjusted to the character of the *Ökotop*, a harmonious cultural region results. This does not imply that these units have also been chosen as settlement units, for settlements are often established to take advantage of two or more units. Small regions of peasant agriculture, with mutual exchange of products, may achieve a degree of stability—but they are vulnerable to changes in general economic development. Dynamic forces radiate from centres of economic, administrative and cultural function (mining areas, industrial centres, ports), and these interfere with, and may completely destroy, the harmonious relations of man and his environment. As a clarification of method, and for its interesting ideas, the essay is worthy of attention.

G. R. C.

THE DRAINAGE OF IRRIGATED LAND

Waterlogged and saline soils have proved the nemesis of newly introduced perennial irrigation, or the substitution of a perennial for a seasonal supply of irrigation water, in arid climates where slopes are insufficient to induce a natural drainage. In a pamphlet of 66 pages 'Drainage and reclamation of irrigated lands, Pakistan' (Karachi, 1949), Sir Roger Thomas reports his observations on a visit to the United States and Egypt in which his purpose was to study conditions physically comparable with those which obtain in the irrigated lands of west Pakistan. The pamphlet contains a clear statement of the causes of deterioration and the remedies that have been applied. A proper balance of nutrient salts in the soil must be maintained; the water requirements of crops, the volume of water supplied, its salt content, the rate of evaporation and the presence of impermeable strata in the soil profile are all factors which must be taken into consideration. Where the water supply is not perennial, the seasonal fall in the water table greatly retards the accumulation of salts in the soil.

The leaching of soils that have become saline by the application of an excess of irrigation water, with or without the cultivation of a crop of rice to make use of it, is usually the simplest remedy. But adequate quantities of water are seldom available and their use must aggravate the other evil, waterlogging; and the cure is only temporary, for the accumulated salts are washed into the subsoil to come to the surface again under normal irrigation.

The true remedy, and the true preventative, is a system of drainage and Sir Roger Thomas described the drainage works undertaken in America and in Egypt. He cites the costs incurred, both for open drains and for buried tile drains which do not withdraw valuable land from cultivation (in Egypt the area occupied by open drains is estimated at 10 per cent.) and do not interfere with the use of tractors and other agricultural machinery. Because of the absence of a natural slope, it is often necessary to pump the effluent into watercourses or back into the irrigation canals. In the Salt River valley of Arizona, where a third of the land had gone out of cultivation in ten years, tube wells have been used with success to lower the water table, but it is pointed out that they require a permeable subsoil to considerable depths and the absence of clay bands that would impede the circulation; conditions that are not generally present in the Indus valley. An impervious lining to irrigation channels is one step towards the avoidance of both evils, and this and the provision of an adequate drainage system should form an integral part of the initial plans for new irrigation; a point which is being attended to in Egypt in preparation for the Lake Victoria project and the diversion of the Nile through the Sudd.

The paper concludes with a review of conditions in west Pakistan, where the total irrigated area of 21 million acres is the largest in the world. In the Punjab alone, the area rendered infertile by the accumulation of salt increased by one and a half million acres between 1932 and 1945; waterlogged lands are also extending yearly. There is a useful bibliography of American professional publications on the subject. F. G.

AN ECONOMIC ATLAS OF THE STATE OF VICTORIA

'Report on regional boundaries,' published by the State Regional Boundaries Committee (Melbourne, 1944) belies its title for the Report itself occupies only the first section of 7 pages and 2 maps and is primarily concerned with a statement of the principles on which the division of the State into regions (which are in effect, natural regions) has been made. The maps show the names and boundaries of the thirteen regions proposed, in relation to local government areas and topography. An appendix of 27 pages contains brief accounts of the geography of each region.

Appendix III is made up of 31 maps on a scale of 1 : 2,000,000, which constitute an economic atlas of Victoria. The first 6 maps portray the physical geography, with particular emphasis on water supply. Land utilisation and soil erosion follow, then 10 maps showing the distribution of crops and livestock and 13 dealing with forestry, geology, industry, population, transport, etc. Finally 14 sketch-maps on one page provide a summary and recapitulation of the whole.

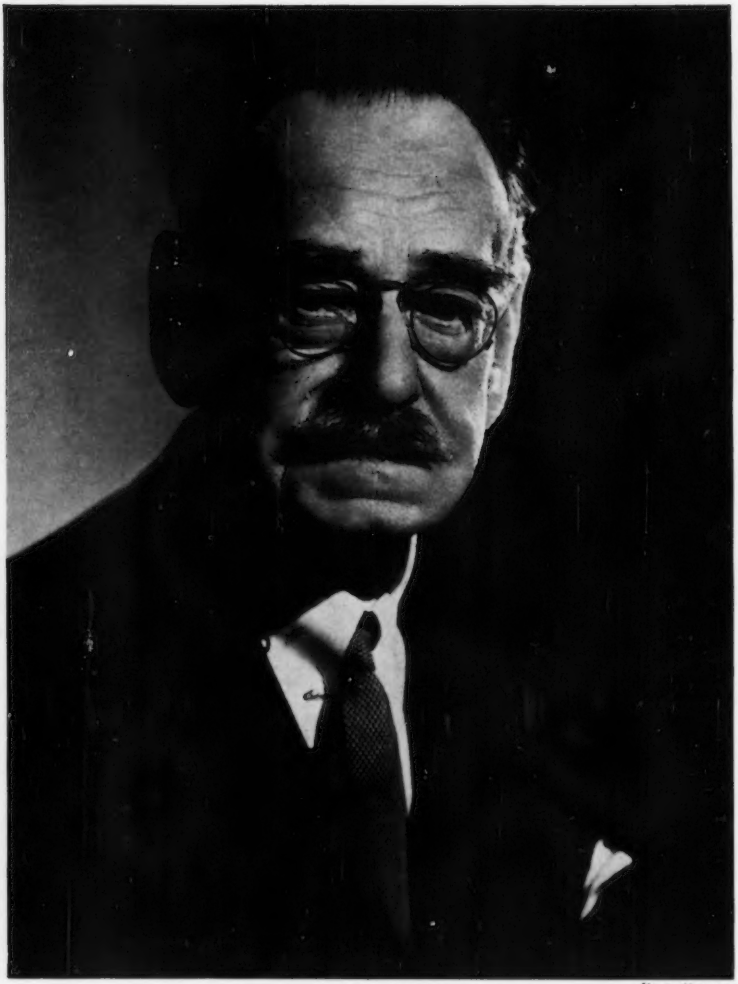
The maps are in general excellent, but several points call for attention. Rural population is shown as density per square mile of settled land, not as a general average over the whole area of each "municipality." This is explained in the text but is not stated on the map itself. The layer colours on the topographical map are startling, and it is a pity that all the places mentioned in the text could not have been marked. It would have been better if quantitative limits had been set to the "first, second and third intensities" of stock raising and crop growing. The term "cattle units" is used in the text but defined only on the map showing distribution of livestock; and "acre feet" (of water) does not appear to be defined at all and may be unfamiliar to English readers. The general lay out is however excellent and the report forms a good, concise introduction to the geography of Victoria. A. M. F.

EXPLANATORY TEXTS TO THE TOWN AND COUNTRY PLANNING MAPS

The Ordnance Survey has recently published the first three of a series of explanatory texts to accompany the now well-known Planning Maps on the scale of 1 : 625,000, which are compiled and edited by the Ministry of Town and Country Planning and the Department of Health for Scotland. The aim of these texts, which are from four to ten pages in length, is to explain the construction and use of the maps in more detail than would be appropriate in the reference panels which appear on the maps themselves. The titles of the first three are 'Land classification,' 'Average annual rainfall,' and 'Population'; the price is 9*d* each.

LOXODROMIC DISTANCES

In a paper on "Loxodromic distances on the terrestrial spheroid" in the April issue of *The Journal of The Institute of Navigation*, Mr. J. E. D. Williams examines the well known formulae for the calculation of distance by the mid-latitude method and their extension to the spheroid. The paper includes a new



Phot. Bassano

Field-Marshal Lord Chetwode

critical table for the correction *m* to be applied to the latitudes of the end points of the loxodrome. He also discusses the errors introduced by the use of Meridional Parts as published in standard collections of navigation tables, when the further correction to the latitudes is omitted, and shows that they may in certain cases, exceed the error that would arise from treating the earth as a sphere. He evinces a somewhat uncritical preference for Hayford's Figure of 1910 over Clarke's Figure of 1880 on which most of the published tables are based; though there is certainly something to be said for using a figure that is now accepted as international.

As an aid to the graphical measurement of loxodromic distances in air navigation, the author suggests that the meridians on Mercator charts should be divided in nautical miles rather than in degrees and minutes, both to avoid the mental arithmetic that the conversion entails and to eliminate the small differences in the lengths of degrees in different latitudes. F. G.

OBITUARY

FIELD-MARSHAL LORD CHETWODE, G.C.B., O.M., G.C.S.I., K.C.M.G., D.S.O.

By the death of Field-Marshal Lord Chetwode the Society has lost a valued friend and supporter. In India the late Field-Marshal had a most distinguished career, beginning with active service in the Chin Hills as a subaltern in 1892–93, Chief of the General Staff 1928–30, and ending his active Indian career as Commander-in-Chief of the Army 1930–35. In the South African war he attained his majority. He served with great distinction in the First World War, not only on the Continent but also in Egypt, Palestine and Syria. He became a full General in 1926 and Field-Marshal in 1933.

But to a later generation he became equally well-known in the arts of peace and particularly for his Chairmanship of the Executive Committee of the Red Cross and St. John Joint War Organization during eight difficult years, 1940–47. Throughout his career, his breadth of vision, his courtesy and unfailing kindnesses, won him many friends.

As Sir Philip Chetwode he succeeded Professor Balfour as President of the Royal Geographical Society in 1938. His first year of office was somewhat interrupted by absence abroad on Government business connected with the exchange of Spanish Civil War prisoners, but this was not allowed to lessen his close attention to the affairs of the Society. He was always anxious that young travellers and scientists should be encouraged and adequately supported, and it was on his initiative that the Expedition Fund was re-established.

Discussion of the best way in which the Society could adapt itself to changing times led to the setting up of a Committee on the future of the Society, which made a number of recommendations since carried out. During that year, 1938, the approach of war was increasingly apparent. As he eloquently expressed it in his speech at the Annual Dinner of 1939, he found the struggle between two opposed ways of life tremendously stimulating, and when war eventually broke out, he was determined that the Society should play its part worthily. In this spirit it was resolved that the Society's work should be maintained in London; only the more valuable books and maps were evacuated to the country, and at

his direction steps were taken to protect the House adequately from the risk of fire and bomb. When a portion of the House was earmarked for possible Government occupation, he worked hard to conclude an agreement securing adequate compensation for the Society. Despite his constant preoccupation as Chairman of the Executive Committee of the Red Cross and St. John Joint War Organization, he nevertheless found it possible to give much time and thought to the continuance of the Society's work in difficult years. From 1941 to 1947 he served as Vice-President, and then as a Trustee. His death is deeply regretted by a wide circle of friends in London, and not least by the Council, Fellows and staff of the Society. H. A. F. L.

ARTHUR MORTIMER CHAMPION

Arthur Mortimer Champion died in Nairobi at the age of sixty-five on 9 May 1950. He had been a Fellow of the Society since 1934. He was educated at Clifton College and in 1905 joined the Indian Army, but after two years was forced to relinquish his commission on account of injuries received in a riding accident. In 1909 he joined the administration in Kenya and, except for the four years of the 1914–18 war when he was with the R.F.A. in Europe, he continued with that service until his retirement in 1935. During the earlier years he was stationed at a number of places including Naivasha, Gilgil, Nyeri, and in the Kavirondo country. From 1931–35 he was Provincial Commissioner of Turkana Province and was awarded the C.M.G. on his retirement.

His leaves he spent in travelling, once in New Zealand and once in Japan, where he journeyed on foot in native dress. On yet another occasion he drove a small car from Cairo to the Cape at a time when this was still a feat. Even during his tours of duty his many interests led him to take every opportunity which his duties afforded to add to our knowledge of the little-known areas in which he found himself. Thus in Turkana his travels enabled him to make an original survey of the Province, which was of the greatest value not only to the administration but also to several scientific expeditions which visited the area during his tenure of office. In addition he made considerable collections of geological material, accompanied always by accurate and illuminating observations. His interests were not confined to survey and geology but included birds, butterflies and flowers and he was for nearly forty years a member of the East Africa and Uganda Natural History Society. He became president of that society and it was only on the day before his death that he resigned the presidency.

On his retirement he continued his interests in out of the way places and took up cinematography as a hobby. In 1937 he built himself a special lorry with which he crossed Africa from East to West, and during the journey made an interesting film which was later shown both in England and abroad. In 1938 he joined the Lake Rukwa Expedition and contributed much to the survey and other work of the expedition. At this time also he was taking a great interest in the problems of the soil erosion which so vitally affects Africa to-day. In 1940 he was re-engaged by the Kenya Government and with the aid of a mobile cinema van explained the war news to native audiences with commentaries on the films. In all he gave some 800 performances in four years to more than a million people.

His publications range from 'Soil erosion in Africa' and 'The reconditioning of native reserves' to 'The physiography of the region of the west and south-west of Lake Rudolf.' In 1939 the Society awarded him the Founder's Medal

and in the same year he received the Order of St. John of Jerusalem. The East African community and this Society have lost a great friend and an active member, with whom it was both a privilege and a pleasure to travel. V. E. F.

CORRESPONDENCE

SOME MEDIEVAL THEORIES ABOUT THE NILE

The Editor has suggested a short summary of the interesting discussion arising out of my paper on Nile sources.[1] There seems still to be great reluctance to agree to my identification of the Mountains of the Moon, but I stand firmly by it. I would again emphasize the fact that it is not the *existence* of snow there but the *belief* in its existence which is required by my argument. Of that belief in ancient times the Adulis inscription is convincing evidence. It seems clear from Colonel Cheeseman's first-hand account that, although snow does fall occasionally, and hail more often, neither does so in sufficient quantity to justify a description of the Simen as snow mountains; but that the illusion of snow is created by the sun shining on short dry grass. If Colonel Cheeseman's companions were deceived by appearances, others may have been so too in all ages.

In a private letter from Addis Ababa, Mr. Stephen Wright corrects some small errors in my paper. At page 12, for "death to donkeys" read "death to mules"; Maitagazi (p. 22) is he suggests Mai-takazé, water (or stream) of Takazé. Damo is he suggests the famous Debra Damo east of Adwa, whose church has recently been reconstituted; he may be right, but its position must then be incorrect, and may well be so. Debat, he thinks, must be Debat on the present main road north-east of Gondar. Dera is certainly the region south-east of Lake Tana, and not the one west of Lake Haikh, as shown on my map (Fig. 2).

More important, he queries the date (before 1454) assigned to the Egyptus Novelo map by Dr. Mannoni and Professor Almagià. He cites Delda equated with Dildi (=bridge) and, from its position on the map, certainly applied to one of the two bridges over the Abai, "either that below the Tis-Abai falls, or the Sabara Dildi (=broken bridge) north of Mota (which is presumably 'Buda')." It is, as he says, most unlikely that either bridge was built before the Portuguese influx; "they are both of the usual 'Gonderine' or 'Fasil' type." Mr. Wright is also disturbed by the name Granemba (written in the MS. with a line over the "e," indicating omission of "m") which he would associate with the sixteenth century Muhammadan conqueror, Ahmed Graṅ. This possibility had in fact occurred to me, but I rejected it because I did not know of any mention of a place so called in any historical document. There is a place west of Lake Tana called on Bruce's map of the lake region Wainadēga or Graneber, but the second form contains *bar* (meaning, I believe, a gate or pass) and not *amba*, a hill-fort. Graneber is traditionally associated with Graṅ, but is much too far away to be associated in any way with Granemba, nor does Mr. Wright suggest that it should be. Unless Bruce's position was wrong, there seems to have been another place of the same name near Dankaz; see Mendes (quoted in Pereira's 'Susenyos,' pp. 605, 608) it was here that Graṅ was killed by the Portuguese. Mendes calls it Granhaber.

[1] *Georgr. J.* 114 (1949) 6–29.

Finally Mr. Wright finds it difficult to believe that "so much relatively accurate information about Ethiopian place-names was available so early as 1454." While admitting that it is surprising, I do not think that it need be an insuperable objection. The authors of the two fifteenth-century itineraries managed to get hold of many names; Fra Mauro's nearly contemporary map is full of names and (for Ethiopia) even more accurate; and Zorzi (about 1522) also secured a great number of names merely by questioning returned travellers at Venice. What he could do could also have been done in the middle of the fifteenth century. The history of the atlas in which the Egyptus Novelo is bound up (Bibliothèque Nationale, Paris, Fonds Latins No. 4802) seems to preclude a date after 1454; but is it not possible that it was rebound at a later date and other maps bound in with the earlier ones?

Mr. Wright, I am gratified to know, accepts my identification of the Mountains of the Moon with the Khamir region. O. G. S. CRAWFORD

23 June 1950.

CAREERS FOR GEOGRAPHERS

In the memorandum "Careers for Geographers," which was printed in the March number of the *Journal*, the following statement appears: [a geographical training] . . . "is also a great asset in the Colonial Service, a fact recognized by the Colonial Office which requires men accepted for the Service to spend a year at Cambridge, at Government expense, in order to receive a training partly in Geography if they are not already so qualified."

This statement is somewhat misleading. Men who have been selected for appointment to the Colonial Administrative Service are normally required to attend a special course of pre-service training either at Oxford or at Cambridge or at London. The broad outline of this course of training (which is restricted to Probationers in the Colonial Administrative Service) is set out in the report of the Committee on Post War Training for the Colonial Service published in 1946 as Colonial No. 198 and includes some study of Geography. At Oxford the Committee for Colonial Studies created a Lectureship in Colonial Geography in 1946. The length of the course has this year been reduced to one academic year, and the amount of time which it is possible to devote to Geography has, in common with other subjects, been correspondingly reduced.

K. E. ROBINSON

Institute of Colonial Studies, Oxford.

12 June 1950.

A SUGGESTION FOR WATER CONSERVATION IN IRAQ

In the countries of the Middle East there is a demand for agricultural research and technical assistance, and it is generally agreed that the full development of water resources is of primary importance in their agricultural development. Similarities exist between these countries and a similar initial approach is desirable. The final report of the United Nations Economic Survey Mission, published in 1949, recognizes that the importance of agricultural development is greatest in Iraq. There is a wide scope in Syria; Israel has mixed interests and is better organized. The Mission suggests detailed planning by experienced specialists, central research stations properly equipped, the recruitment abroad of specialist officers and, at the same time, a provision for training nationals abroad to take their places.

In a paper in the *Journal of The Institute of Civil Engineers* (1945) I put forward

a project which would implement these proposals by conserving water in Iraq. It aimed at giving complete protection, and the maximum storage and command by combining the rivers Euphrates and Tigris to form a huge reservoir at the head of the Delta. With the saving of water thus effected it is suggested that a canal taking off from the Euphrates near Aleppo should be built for the irrigation of Syria. As this would bring water as far as Homs, it is further suggested that a small piped supply be carried over for the generation of electricity in the valley of the Jordan and the Dead Sea. Thus irrigation and power would be developed on a long-term progressive programme. Uncoordinated programmes are to be deplored as they must result in much loss and inefficiency.

But there are related short term programmes which may be put in hand at once. These would aim at harnessing the hill torrents after they have debouched on to the plains. The torrents may then be controlled by earthen dams protected with brushwood on the still-water pocket principle. On the Baluchistan Frontier of Pakistan (then the Punjab) local people carried out and maintained such works themselves, under the guidance of Government officers. The water after being controlled at the dam was led over the higher lands and cultivation on the basin system was carried out as in Egypt. This was something better than mere terracing though it is similar, and by it all loss of water was avoided and soil erosion arrested. There was a Record of Rights, by which each cultivator was apportioned shares in land and water, and he was bound to contribute his share in labour for constructing and maintaining the common works. The Baluchis and their land are very similar to the Arabs and their land and there is no reason why this system should not be introduced in the Middle East. By it the way to the larger works would be opened out in the simplest manner. In a later manuscript, which I shall be glad to place at the disposal of anyone interested, I have developed these suggestions in detail and present their practical application.

P. CLAXTON

11 *June* 1950

ADDITIONS TO THE LIBRARY AND MAP ROOM

EUROPE

EUROPE: a regional geography

By M. R. Shackleton. 4th ed. $8\frac{1}{2} \times 5\frac{1}{2}$. xvi+526 pp. Sketch-maps and illustrations. *London: Longmans Green*, 1950. 21*s*

A revised and enlarged edition of this well-known textbook, completed shortly before the author's death. The economic and historical aspects receive greater attention. The bibliographies have been added to; they still contain items of very varying value.

WARWICKSHIRE

By A. Burgess (*County Books Series*). $8\frac{1}{2} \times 5\frac{1}{2}$. viii+312 pp. Illustrations. *London: Robert Hale*, 1950. 15*s*

TEMPESTUOUS ISLE: the story of Lundy

By P. T. Etherton and V. Barlow. $8\frac{1}{2} \times 5\frac{1}{2}$. 144 pp. Illustrations. *London: Lutterworth Press*, 1950. 12*s* 6*d*

A well-illustrated account of the island, particularly of its history and ornithology, based on personal knowledge.

ULSTER

By Hugh Shearman (*County Books Series*). $9 \times 5\frac{1}{2}$. xii+428 pp. Illustrations. *London: Robert Hale*, 1949. 15*s*

Mr. Shearman has covered a very wide field in this readable volume, beginning with geology and prehistory. He shows the Ulster people as a cultural unit, with a way of life closely related to the environment, and he illuminates his account pleasantly with personal experiences and anecdotes.

LES FONDEMENTS GÉOGRAPHIQUES DU PORT D'ANVERS

By C. Petit. (*Bull. Soc. Belge d'Études Géogr.* 18 (1949) 103–92)

LES CARACTÈRES DE LA VIE PASTORALE DANS LE BASSIN SUPÉRIEUR DE L'ARIÈGE

By M. Chevalier. (*Rev. Géogr. des Pyrénées et du Sud-Ouest*, 20 (1949) 5–84)

AVIGNON: esquisse de géographie urbaine

By François Maugard. (*Bull. Soc. Languedoc. de Géogr.* 20 (1949) 13–164)

LE RELIEF DE LA BRETAGNE MERIDIONALE

By A. Guilcher. $10 \times 6\frac{1}{2}$. 682 pp. Illustrations and maps. *La Roch-sur-Yon: H. Potier*, 1948. 38*s*

DIE UMGEBUNG BERLINS NACH MORPHOLOGISCHEN FORMENGRUPPEN BETRACHTET.

By W. Behrmann. (*Veröff. Geogr. Inst. der Freien Universität Berlin*, No. 1, 29 pp.; sketch-maps)

Repr. fr. *Die Erde, Berlin*, Hf. 2 (1949–50) 93–122

BEITRÄGE ZUR LANDWIRTSCHAFTSGEOGRAPHIE DER LAUSITZ

By H. Kucharski. (*Berliner Geogr. Arbeiten* Hf. 22; pp. 102; maps)

IL GRAN SASSO D'ITALIA (versante meridionale)

By M. Ortolani and A. Moretti. (*Ric. sulla morphol. e idrologia carsica, Consiglio naz. delle Ricerche, Bologna*, No. 2, 1950, pp. 120; illustrations and maps)

LA PIANA DEL SELE

By E. Migliorini. (*Mem. di geogr. economica, Univ. di Napoli*, 1 (1949) 176 pp.; illustrations)

The first volume of a new series published under the auspices of the Consiglio Nazionale delle Ricerche. It is a study in agricultural geography, and opens with a discussion of the place of that subject in geography.

UNE EXCURSION GÉOGRAPHIQUE EN VÉNÉTIE

By A. Gibert. (*Rev. de Géogr. de Lyon*, 25 (1950) 1–8)

This number contains four articles on the geography of Venice and region.

IL PORTO DI VENEZIA

By L. Candida. (*Mem. geogr. economica, Univ. di Napoli*, 2 (1950); 232 pp.)

VICENDE DELL'INSEDIAMENTO UMANO IN SARDEGNA

By Alberto Mori. (*Bol. Soc. Geogr. Ital. Ser.* VIII, 2 (1949) 253–86; maps)

NORRA SVERIGES SÅGVERKSINDUSTRI

By Harald Wik. (*Geographica nr.* 21, *Upsala*, 1950, pp. 328; maps and illustrations)

A detailed study of the sawmill industry in Norrland from the middle of the 19th century to 1937. Brief English summary.

MADEIRA: eine länderkundliche Skizze des Archipels

By H. Lautensach. (*Erdkunde*, 3 (1949) 212–29; sketch-maps)

SPAIN

By Sacheverill Sitwell. $8\frac{1}{2} \times 5\frac{1}{2}$. xii+148 pp. *London: Batsford*, 1950. 16*s*

GEOGRAFIA ECONÓMICA DE ESPAÑA

By F. Cortada Reus. $8\frac{1}{2} \times 5\frac{1}{2}$. 392 pp. Sketch-maps and diagrams. *Barcelona: M. Arimany*, 1946. 25*s*

RATE OF GROWTH OF TOWNS IN U.S.S.R. AND CAPITALIST COUNTRIES

By O. A. Konstantinov. (*Bull. All Union Geogr. Soc. Leningrad*, 81 (1949) 577–83). *In Russian*

EROSION AND FLOW OF ALLUVIUM IN EUROPEAN U.S.S.R. AND NORTHERN CAUCASIA

By G. V. Lopatin. (*Bull. All Union Geogr. Soc. Leningrad*, 81 (1949) 473–83; maps). *In Russian*

ASIA

A SYNOPSIS OF THE STRATIGRAPHY AND GEOLOGICAL HISTORY OF CYPRUS

By F. R. S. Henson, R. V. Browne, and J. McGinty. (*Quart. J. Geol. Soc.* 105 (1949) 1–41; maps)

ARABIAN HIGHLANDS, 1936–37

By H. St.J. B. Philby. Typescript. $13\frac{1}{2} \times 9\frac{1}{2}$. Narrative of journey for the demarcation of the Saudi Arabia–Yaman boundary. Presented by the author

ABBÉ DAVID'S DIARY

Ed. and transl. by H. M. Fox. $8\frac{1}{2} \times 5\frac{1}{2}$. xxxii+302 pp. Illustrations. *Cambridge, Mass.: Harvard U.P.* (*G. Cumberlege*), 1949. 36*s*

Armand David was an early worker on the natural history of Eastern Asia, and made extensive collections of the flora and fauna of Mongolia, Szechwan and Shansi.

IRON AND STEEL INDUSTRY IN BENGAL–BIHAR INDUSTRIAL BELT

By B. Ganguli. (*Calcutta G. Rev.* 11 (1949), No. 3, 18–24)

GEOGRAPHICAL DESCRIPTION OF MANCHURIA

By V. A. Anuchin. 8×5. 300 pp. Illustrations and maps. *Moscow: State Publ. House for Geogr.*, 1948. *In Russian.*

AM RANDE DES PAZIFIK: Studien zur Landes- und Kulturkunde Südostasiens

By K. Helbig. 9×6. xii+324 pp. Illustrations. *Stuttgart: W. Kohlhammer*, 1949. D.M. 19.80.

The author is concerned particularly with the results of the four centuries of European control, and with the character and effects of the Chinese immigration.

THE ECONOMIC DEVELOPMENT OF SOVIET CENTRAL ASIA TO THE EVE OF WORLD WAR II

By P. B. Henze. (*R. Cent. Asian J.* 37 (1950) 28–44)

THE MOUNTAINS OF SINKIANG

By H. W. Tilman. (*Himalayan J.* 15 (1949) 9–17; illustrations)

NEW DATA ON THE MORPHOMETRY OF THE ARAL SEA

By M. A. Fortunatov and V. D. Serjienko. (*Bull. All Union Geogr. Soc. Leningrad*, 82 (1950) 51–58; map.) *In Russian*

AFRICA

CHINA'S DISCOVERY OF AFRICA

By J. J. L. Duyvendak. 10×6. 36 pp. Illustrations. *London: A. Probsthain*, 1949

A history of Chinese knowledge of Africa, indirect at first through trade relations, but founded on actual Chinese voyages to the east coast in the first half of the 15th century.

DIE GEWASSER OSTAFRIKAS: Erläuterung zur Gewasserkarte 1 : 4M

By F. Jaeger. (*Erdkunde*, 3 (1949) 199–212. Folding map)

GÉOGRAPHIE DU MAROC

By F. Joly and others. $8\frac{1}{2} \times 5\frac{1}{2}$. 168 pp. Illustrations and maps. *Paris: Delagrave*, 1949

This school text contains much information in a compact form.

NORDAFRIKA

By W. Wrage. 2 vols. $12\frac{1}{2} \times 9\frac{1}{2}$. 138, 126 pp. Map and illustrations. *Leipzig: Fikentscher Verlag*, 1942

A SOIL RECONNAISSANCE JOURNEY THROUGH PARTS OF TANGANYIKA TERRITORY, Dec. 1935–Feb. 1936

By G. Milne. (From *J. of Ecology*, 35 (1947) 192–265; map and illustrations)

AMERICA

DIE JUNGALGONKISCHE REGENERATION IM RAUME AMERIKAS

By H. Stille. (*Abhandl. z. Geotektonik*, No. 1, *Deut. Ak. Wissens.*) 11×8, 40 pp. *Berlin*, 1949

MEET MR. GRIZZLY

By M. Stevens. $8\frac{1}{2} \times 5\frac{1}{2}$. 286 pp. Illustrations. *London: Robert Hale*, 1950. 15*s*

Reminiscences of bear hunting in the Rockies in the 'nineties, unpretentious and discursive.

PROBLÈMES DE GÉOGRAPHIE ANTILLAISE
By E. Revert. (*Cahiers d'Outre-mer*, 3 (1950) 1–27; illustrations)

LES EAUX SOUTERRAINES DANS LA PLAINE DES GONAIVES, HAÏTI
By G. C. Taylor and R. C. Lemoine. (*Rev. Soc. Haitienne de Géogr.* 20 (1949), No. 75, 8–33; map)

DIE SPANISCHE KOLONIALSTADT IN SÜD-AMERIKA; Grundzüge ihrer baulichen Gestaltung
By H. Wilhelmy. (*Geogr. Helvetica*, 5 (1950) 18–36; illustrations)

SOUTH AMERICA: an introductory survey
By E. G. Ashton. (*Harrap's New Geogr. Ser.*) 8×5. 272 pp. *London: G. C. Harrap*, 1950. 8*s* 6*d*

HANDBOOK OF LATIN AMERICAN STUDIES, 1946
No. 12. Prepared by the Hispanic Foundation of the Library of Congress; ed. by F. Aguilera and C. Shelley. 9×5½. x+364 pp. *Cambridge, Mass.: Harvard U.P.* (*G. Cumberlege*), 1949. 68*s*
The notes on the geographical entries are contributed by Profs. C. F. Jones, G. McC. McBride, and P. E. James.

RELEVO DE "CUESTAS" NA BACIA SEDIMENTAR DO RIO PARAMA
By F. F. M. de Almeida. (*Bol. Paulista de Geogr.*, No. 3 (1949) 21–33)

EVOLUÇÃO DAS VIAS DE COMUNIÇÃO NO ESTADO DO RIO DE JANEIRO
By O. Nogueira de Matos. (*Bol. Paulista de Geogr.* No. 3 (1949) 51–75; sketch-maps)

LE PARAGUAY
By Jean Sermet. (*Cahiers d'Outre-mer*, 3 (1950) 28–65; illustrations and sketch-maps)

STORM CLOUDS OVER THE ANDES
By C. L. White. (*Scientific Monthly*, 70 (1950) 305–16; illustrations)
An examination of the plight to which the Indians of the Peruvian Sierra have been reduced, and the changes which are foreshadowed through the breaking down of their isolation.

STONE RUNS OF THE FALKLAND ISLANDS
By J. R. F. Joyce. (*Geol. Mag.* 87 (1950) 105–15; illustrations)

AUSTRALASIA AND PACIFIC

THE SIZE OF THE AUSTRALIAN DESERT
By Ann Marshall. (*Australian Geogr.* 5 (1948) 168–75)

GREEN PASTURES: an account of the dairy industry in the Richmond Tweed districts of New South Wales
By J. Bechervaise. (*Australian Geogr. Mag.* March 1950, 10–18)

A HOMESTEAD HISTORY: being the reminiscences and letters of Alfred Joyce
Ed. by G. F. James. 2nd ed. 8½×5. 220 pp. Illustrations. *Melbourne: Univ. Press* (*Cambridge U.P.*) 1949. 12*s* 6*d*
An informative and readable account of the experiences of a London apprentice who migrated to Australia in 1843. At first a pioneer pastoralist, Joyce established himself as a wheat grower and miller in Victoria.

THE ROAD TO THE GULF
By George Farwell. (*Australian Geogr. Mag.*, April 1950, 10–17; illustrations)
Impressions of the country between Cloncurry and the Gulf of Carpentaria.

OURSELVES WRIT STRANGE
By Alan Marshall. 9×5½. 322 pp. Illustrations. *Melbourne: F. W. Cheshire.* (*London: Allen and Unwin*) 1949. 15*s*
An account of a journey from Thursday Island through the Gulf of Carpentaria to Arnhem Land, and of the present condition of the aboriginal inhabitants, with discussions of the problem of their position in the modern world.

SOME UNUSUAL SHORE PLATFORMS NEAR GISBORNE, NORTH ISLAND, NEW ZEALAND
By E. D. Gill. (*Trans. & Proc. R. Soc. New Zealand*, 78 (1950) 64–8; illustrations)

AN ERODED COASTLINE
By R. Speight. (*Trans. & Proc. R. Soc. New Zealand*, 78 (1950) 3–13; illustrations)
A section of the Ninety Mile Beach, Canterbury.

POLAR REGIONS

PLACE-NAMES IN THE SOVIET ARCTIC
By Terence Armstrong. (*Polar Record*, 5 (1950) 408–26)

DIE FRANZÖSISCHEN POLAREXPEDITIONEN 1948–50. Vorexpedition nach Grönland 1948
By H. Poser. (*Petermanns Mitt.* 94 (1950) 34–6)

A BIOLOGICAL EXPLORATION OF BANKS AND VICTORIA ISLANDS
By A. E. Porsild. (*Arctic Circular*, 3 (1950) No. 1, 1–9)

ANTARCTIC NATURE

By S. V. Kalesnik. (*Bull. All Union Geogr. Soc. Leningrad*, 81 (1949) 557–68) *In Russian*

PHYSICAL AND HUMAN GEOGRAPHY

THE COSMOGONIC THEORY OF O. Y. SCHMIDT AND EARTH STRUCTURE

By P. N. Kropotkin. (*Bull. Ac. Sc. U.S.S.R., Geogr. Ser.* 14 (1950) 37–63; diagrams) *In Russian*

LES IDÉES NOUVELLES SUR L'ORIGINE DES CHAINES DE MONTAGNES

By L. Moret. (*Rev. de Géogr. Alpine*, 38 (1950) 223–78; diagrams)

LE PROBLÈME DES MÉANDRES

By H. Baulig. (*Bull. Soc. Belge Études Géogr.* 17 (1948) 103–43; diagrams)

DYNAMICAL PROCESSES OF RIVER BED STRUCTURE

By M. A. Velikanov. (*Bull. Ac. Sc. U.S.S.R. Geogr. Ser.* 13 (1949) 497–512; illustration and diagrams). *In Russian*

THE PHYSICS OF THE SEA IN THE SCIENCES DURING THE STALIN EPOCH

By V. V. Shuleykin. (*Bull. Ac. Sc. U.S.S.R., Geogr. Ser.* 14 (1950) 7–24). *In Russian*

RECENT CLIMATIC FLUCTUATIONS

By Leo Lysgaard. (*Folia Geogr. Danica*, 5 (1949). Pp. 86, 94; diagrams)

The tables give overlapping thirty-year normals for temperature, precipitation, pressure, etc.

CLIMATIC REQUIREMENTS OF SOME MAJOR VEGETATIONAL FORMATIONS

By A. Austin Miller. (*Adv. of Science*, 7 (1950) 90–94)

PRINCIPLES OF HUMAN GEOGRAPHY

By P. Vidal de la Blache. Ed. by Em. de Martonne; trsl. by M. T. Bingham. $8\frac{1}{2}\times5\frac{1}{2}$. xvi+512 pp. Maps. *London: Constable*, 1950. 20*s*

A reprint of the 1926 edition.

KULTURFÖRDERNDE UND -HEMMENDE FAKTOREN IN DER TROPEN

By W. Brünger. (*Petermanns Mitt.* 94 (1950) 24–33)

A DEMOGRAPHIC SURVEY OF THE BRITISH COLONIAL EMPIRE

By R. R. Kuczynski. (*R. Inst. Internat. Affairs.*) Vol. I. West Africa. Vol II. S. Africa High Commission Territories, East Africa, Mauritius, Seychelles. $9\frac{1}{2}\times6\frac{1}{2}$. xiv+822; x+984 pp. *Oxford Univ. Press* (*G. Cumberlege*), 1948, 1949. 75*s each vol.*

An intensive study of all the material available, with critical consideration of the census methods, and discussion of the future of population in each colony.

SOIL EROSION AND CONSERVATION IN THE COLONIAL DEPENDENCIES

By Sir Harold Tempany. (*J.R. Soc. Arts*, 98 (1950) 549–67; illustrations)

IMPERIAL MILITARY GEOGRAPHY

By D. H. Cole. 10th ed. $8\frac{1}{2}\times5\frac{1}{2}$. x+318 pp. Maps. *London: Sifton Praed*, 1950. 20*s*

The first post-war edition of a book first published in 1924. The subject is interpreted widely, yet the treatment is quite detailed, so that it is a useful general reference work.

SOVIET IMPERIALISM: Russia's drive towards world domination

By E. D. Carman. 9×6. 176 pp. *Washington, D.C.: Public Affairs Press*, 1950. $3.25

A HISTORY OF EXPLORATION FROM THE EARLIEST TIMES TO THE PRESENT DAY

By Sir Percy Sykes. 3rd ed. 10×6. xiv+426 pp. Maps and illustrations. *London: Routledge and Kegan Paul*, 1950. 30*s*

The first edition, published in 1934, was reviewed in the *Journal* 83 (1934) 438. Some summaries of later journeys were added by the author before his death in 1945.

MANY HAPPY DAYS I'VE SQUANDERED

By A. Loveridge. $8\frac{1}{2}\times5$. x+244 pp. Illustrations. *London: Robert Hale*, 1949. 12*s* 6*d*

The Curator of Reptiles, Museum of Comparative Zoology, Havard, relates his autobiography engagingly and with enthusiasm.

A HUNDRED YEARS OF ARCHAEOLOGY

By G. E. Daniel. $8\frac{1}{2}\times5\frac{1}{2}$. 344 pp. *London: Gerald Duckworth*, 1950. 21*s*

OLD IRELAND AND NEW ENGLAND

By E. E. Evans. (From *Ulster J. of Archaeol.* 12 (1949) 104–112)

CHALLENGE: an anthology of the literature of mountaineering

Ed. by W. R. Irwin. 9×6. xx+444 pp. *New York: Columbia U.P.*, 1950

The editor has included fiction and *belles lettres* as well as narrative passages by nineteenth and twentieth century mountaineers, excluding the Mt. Everest Expeditions. The extracts are longer than is usual in anthologies, and cover most aspects of man's response to the mountains.

THE SIGNIFICANCE OF THE WORKS OF I. V. STALIN FOR GEOGRAPHY
By S. V. Kalesnik. (*Bull. All Union Geogr. Soc. Leningrad*, 82 (1950) 3–18) *In Russian*

ATLASES AND MAPS

EUROPE

GREAT BRITAIN. ORDNANCE SURVEY. Six-inch Map. Provisional Edition on National Sheet Lines, 1 sheet, 4*s*; 165 Quarter Sheets, 2*s each sheet;* 1 : 25,000, 95 sheets, 2*s each sheet. Chessington*, 1949–1950

GREAT BRITAIN. 1 : 625,000. Population Changes by Migration 1931–1939. 2 sheets. *Chessington: Ordnance Survey*, 1949, 5*s each sheet*

DENMARK. Atlas of Denmark, editor Niels Nielsen. Part 1, The Landscapes. 22×15. 32 pp. of maps. Text 11½×8. 128 pp. *Copenhagen, The Royal Danish Geographical Society*, 1949

SPAIN. Charts Nos. 10, 58, 85, 508. *Cadiz: Instituto Hidrográfico de la Marina*, 1950

SWITZERLAND. Carte de la Végétation de la Suisse; levé et rédaction par Emil Schmid. 1 : 200,000. Sheets 1, 2, 4. *Geneva: Comm. Phytogéographique de la Société Helvétique des Sciences Naturelles*, 1949

ASIA

JORDAN. The Hashemite Kingdom of the Jordan. 1 : 250,000. Sheets: Amman, Karak, Ma'an. English and Arabic editions; Archaeological Map 1 : 250,000. Sheets: as above. *Amman: Dept. of Lands and Surveys*, 1949. 3*s each sheet, paper;* 4*s cloth*

NORTH BORNEO. Jesselton Area. 1 : 5,000. Sheets: 5, 7, 8. *Teddington: Directorate of Colonial Surveys*, 1950. 2*s* 6*d each sheet*

SYRIA. Carte régulière du Levant au 50,000e, 25 sheets. *Paris: Institut Géographique National*, 1942–1949

AFRICA

ALGERIA. Carte de l'Algérie au 50,000e, 19 sheets. *Paris: Institut Géographique National*, 1943–1948

ANGLO-EGYPTIAN SUDAN. Upper White Nile Air Survey Maps 1 : 50,000, 19 sheets. *El-Giza: Survey of Egypt*, 1948

FRENCH EQUATORIAL AFRICA. Afrique Equatoriale Française 1 : 100,000, 1 sheet; 1 : 200,000, 42 sheets. *Brazzaville: Service Géogr. de l'A. E. F.*, 1948–1949

FRENCH WEST AFRICA. Afrique Occidentale Française 1 : 200,000, 35 sheets. *Dakar: Service Géographique de l'A. O. F.*, 1940–1949

FRENCH WEST AFRICA. Croquis Routier 1/1M. Dahomey et Togo, Côte d'Ivoire, Guinée, Sénégal. *Dakar: Service Géogr. de l'A. O. F.*, 1948

KENYA. 1 : 50,000. Preliminary Plot. 8 sheets. *Teddington: Directorate of Colonial Surveys*, 1950. 2*s each sheet*

KENYA. Nairobi 1 : 25,000. *Nairobi: Survey Dept.*, 1948

MADAGASCAR. Carte Géologique de Reconnaissance au 1 : 200,000, 9 sheets. *Tananarive: Service des Mines*, 1948

MOROCCO. Carte du Maroc au 50,000e, 9 sheets; 100,000e, 11 sheets. *Paris: Institut Géographique National*, 1946–1949

NIGERIA. 1 : 62,500. Preliminary Plot. 51 sheets. *Teddington: Directorate of Colonial Surveys*, 1950. 1*s* 6*d each sheet*

NORTHERN RHODESIA. 1 : 50,000. Preliminary Plot. 6 sheets. *Teddington: Directorate of Colonial Surveys*, 1950. 2*s each sheet*

TANGANYIKA TERRITORY. 1 : 50,000. Preliminary Plot. 18 sheets. *Teddington: Directorate of Colonial Surveys*, 1950. 2*s each sheet*

TUNISIA. Carte de Tunisie au 50,000e, 4 sheets. *Paris: Institut Géographique National*, 1947–1948

UNION OF SOUTH AFRICA. 1 : 250,000, 32 sheets; 1 : 500,000, 6 sheets; 1/1M, 4 sheets. *Mowbray: Trigonometrical Survey*, 1944–1950

AMERICA

CANADA. National Topographic Series. 1 : 63,360, 13 sheets. *Ottawa: Dept. of Mines and Resources*, 1949

CANADA. British Columbia. Degree Sheet Series, 1 : 126,720, 1 sheet; Pre-Emptor's Series 1 : 190,080, 2 sheets; Land Series 1 : 253,440, 1 sheet. *Victoria: Dept. of Lands and Forests*, 1949

TRINIDAD. Motor roads and other means of communication 1 : 250,000; Port of Spain 1: 10,560. *Port of Spain: Survey Dept.*, 1948

UNITED STATES. Topographic sheets. 1 : 24,000, 30 sheets; 1 : 31,680, 3 sheets; 1 : 62,500, 15 sheets. *Washington: U.S. Geological Survey*, 1950

UNITED STATES. Northwestern United States and neighbouring Canadian provinces. 1 : 2·5M. *Washington: National Geographic Society*, 1950

AUSTRALASIA AND PACIFIC

TASMANIA. State Maps 1 : 253,440, 6 sheets; 1 : 506,880, 1 sheet. *Hobart: Surveyor General*, 1944–1946

VICTORIA, Report on regional boundaries. 13×19. 32 pp. of maps, 40 pp. text. *Melbourne: State Regional Boundaries Committee*, 1944

FIJI. Vanua Levu 1 : 126,720; Lautoka, Nausori, Suva 1 : 12,672; Suva and Suburbs 1 : 12,000. *Suva: Dept. of Lands, Mines and Surveys*, 1945–1949

MEETINGS: SESSION 1949–50

Nineteenth Meeting, 8 May 1950

Films: American Journeys. Colour films with commentary by G. C. Schluter

Twentieth Meeting, 15 May 1950

Elections to Fellowship: William S. Beckett; Niall Brennan; Miss Alma Bruce; Gerald L. Burke, M.C., B.SC., A.R.I.C.S., A.M.T.P.I.; G. W. David Chittenden; Ronald A. T. Codrai; Lieutenant-Commander A. H. Cooper, R.A.N.; Harry Fidler, B.M., B.CH., M.A.; Alfred G. Gent; Evan R. Gill; Patrick S. Gilson, B.A.; Captain D. A. R. Hanvey; P. W. Hughes; Vincent Lee-Brown; Miss Rosalie E. Mayo, B.SC.; Rev. William M. Minto; Ronald Neaves; Samuel E. Newman; Captain Arthur P. Paterson; Mrs. Noel Preeston; Alfred John Stoloff; Fred Stone; Edward E. Stroud, B.A.; Ernest M. Welsman

Transferred from Associate Membership: James Eric Thompson

Elections to Associate Membership: David John Atkinson; Alan Paul Carr; Miss P. D. Hinton; Miss Elizabeth Miller; Ernest Richards Rogers; Miss Dorothy Shea; Peter Thompson

Paper: The English scene and the National Trust. By the Right Honourable the Earl of Rosse

Twenty-first Meeting, 22 May 1950

Paper: Recent Geographical developments in East Africa. By E. B. Worthington

Twenty-second Meeting, 5 June 1950

Elections to Fellowship: Benedict O. S. Adophy; Captain Sture O. Andersson; James A. A. Brown; Angus Erskine; Walter Fairbank; Jack Fleming, M.A.; George W. J. Franklin; Lieutenant-Commander George L. Gore, R.D., R.N.R.; Captain Andrew D. Holden, O.B.E., D.S.C., R.D., R.N.R.; Adebayo O. Morgan; H. F. Perrin; M. F. Schrantz; Victor S. Sly, B.SC., A.M.INST.C.E., A.M.I.STRUCT.E.; John D. Soans, A.M.I.M.I.; A. R. Stobbs; S. Terawanij, B.A.; Mrs. M. Mary Wheeler; Miss Neroli M. Wilkins, M.A.; Dr. Harry Bernard Wright

Transferred from Associate Membership: T. John Fowle; John A. Hargreaves

Election to Associate Membership: Charles R. L. Harington

Paper: United States Expedition to Nepal. By Professor Dillon Ripley

The following were elected to Fellowship and Associate Membership of the Society on 17 July 1950

Elections to Fellowship: Frank Atkinson, B.SC.; Kenneth Stanley Bailey; K. V. Blaiklock; Miss Ines Blanch; Ralph Barnes; Mrs. D. A. Brown; Basil George Clarke; Miss Margaret J. Ellis; Peter Ellis; Miss Margaret Anne Lindsay Field; Thomas Walter Freeman; Harold Edmund Gardner; Philip Nail Hains, M.A.; Squadron Leader H. A. N. Hamersley, R.A.F.; Raymond Pattison Hedley, A.L.C.M.; Kenneth Herbert; Mrs. Joan Dorothy Herman; Norman Hilton; Thomas Maxwell-Hudson; Francis Jayatileke, F.R.A.S.; Kasali Aremu Kotun; Thomas Bourhill Lawrie; David Thomas Lloyd, B.A.; Damrong Madhayamanandana; Ewart John Maggs; J. E. Mallory; Lieutenant-Colonel Eric Marshall, O.B.E.; Alec John Matthews; Commander Herbert Claude Millett; C. L. Norman; Miss Ingibjorg Olafsson; Rasaki Oladipo Oseni; Major Charles Ainsworth Payne; Gordon Prior, B.SC.; Vincent A. Saunders; Hugo Schauman; Robert Bateson Smith; William Laing Stewart; Bernard S. Stonehouse; James Reginald Stuart; F. Wallace Taber; Captain Gilbert Thompson, O.B.E., R.D., R.N.R.; Miss Elsie M. Tonkin; Deryk Edward Wakem, B.A.; Lieutenant Coghzan Watson, R.N.; John Philip Watson.

Election to Associate Membership: Miss Daphne Hill

ANNUAL GENERAL MEETING, 19 June 1950. The PRESIDENT, Sir Harry Lindsay, in the Chair

The PRESIDENT: May it please Your Royal Highness: On behalf of all Fellows of the Royal Geographical Society and their guests present at this annual general meeting of the Society, may I extend to Your Royal Highness a very loyal and heart-felt welcome to the Society's House. A year ago we had looked forward to Your Royal Highness's presence, but the sudden and serious illness of your sister prevented you from joining us on that occasion. To-day we are more fortunate. We are indeed proud and delighted that our beloved Honorary President is with us and has graciously consented to address us later and to present the annual medals and awards of the Society.

May I now, with Your Royal Highness's permission, proceed to the formal business of the meeting?

Her Royal Highness having graciously assented, the HON. SECRETARY, Mr. Leonard Brooks, read the Minutes of the Annual General Meeting held on 13 June 1949 which, having been confirmed, were signed by the President.

The PRESIDENT then gave a summary of his Presidential Address which is printed in full at pages 1 to 6 of this *Journal*.

H.R.H. THE DUCHESS OF KENT: Sir Harry Lindsay, Ladies and Gentlemen:

I have been much interested, Mr. President, in the account you have given of the activities of the Royal Geographical Society during the last year, and have been especially impressed by the importance which the Society attaches to its work in the international field.

The remarkable discoveries and scientific achievements of recent years have altered our whole outlook towards the world. We are perhaps more than ever conscious of the world's relative smallness, and countries and continents which once seemed remote are now but a few hours' journey. With this advance in scientific knowledge, a corresponding improvement in human relationships, and in understanding between peoples of all nations, is earnestly to be hoped for, and it is, I believe, the duty of every learned Society to foster this spirit, through the disinterested pursuit of knowledge, and the constant interchange of ideas.

The Royal Geographical Society, of which I am very happy to be Honorary President, has given practical expression to these ideals since it decided, over a century ago, to make awards to men of all nations for outstanding contributions to the cause of discovery. I was therefore much disappointed that I was unavoidably prevented last year from presenting these awards; but I am very glad indeed to be able to do so this afternoon, and I thank you for your kind welcome to me on this, my first visit to the Society's House.

The PRESIDENT: May I, on your behalf, thank our Honorary President very sincerely for her encouraging remarks. They will be an inspiration both to your Council and to all Fellows of the Society in planning their future policy and activities. We now proceed to the presentation of the medals and awards. Your Council, with His Majesty's approval, has awarded the Patron's Medal to Professor Harald Sverdrup, Director of the Norwegian Polar Institute.

Professor Sverdrup has had long experience of Polar work, from the years when he worked as oceanographer and meteorologist on Amundsen's expedition to the Arctic in the *Maud*. Later he continued his oceanographical work in the Pacific as Professor of Oceanography at the University of California. He has also taken part in expeditions to Spitsbergen, investigating the characteristics of glaciers. In his present post, he has been one of the prime movers in the Norwegian-British-Swedish Antarctic expedition, which is now at work in Queen Maud Land.

Professor HARALD SVERDRUP: I would like to express my very deep appreciation of the honour shown to me on this occasion. I am particularly happy to receive this distinguished award now because, as mentioned by your President, British and Norwegian scientists and technicians are now facing hardships together in the Antarctic. In February of this year they established their base station on the shelf ice of Queen Maud Land and for nearly two years more they expect to work together in further exploration of that most desolate part of the Antarctic. The expedition is unique in that it is the very first to have been sent out jointly by three different nations, Great Britain, Norway and Sweden. During the preparations which have gone on for nearly three years there has been the very closest collaboration between the Royal Geographical Society and the Norwegian Polar Institute.

I hope I may consider this award not only as a recognition of what I may have accomplished personally but even more as an expression of approval of the international scientific exploration of the Polar regions by that expedition, exploration which it has been the good fortune of my Institute and myself to help to promote.

The PRESIDENT: The Founder's Medal has, with the approval of His Majesty the King, been awarded to Mr. G. F. Walpole. Mr. Walpole, who is now Director of the Department of Lands and Surveys, Kingdom of the Jordan, was for many years in the Survey of Egypt. As a member of the Desert Survey Section, he did much work in the Western Desert, including the mapping of the great Qattara depression, a physical feature which played an important role in the last war. Mr. Walpole was the first to show that nearly 20,000 square kilometres of it were below sea-level, and to point out its possibilities as a source of power.

The medal will be received on behalf of Mr. Walpole by His Highness Prince Abdul Majid Haidar, Minister for the Hashimite Kingdom of Jordan.

His Highness PRINCE ABDUL MAJID HAIDAR: Your Royal Highness, I am very sorry that I cannot keep this beautiful medal for myself! However, I am here to receive it on behalf of Mr. Walpole who, owing to pressure of business, had to return to Amman; he has asked me to express his grateful thanks and

high appreciation of the honour that the Society has done him in awarding him the Founder's Medal.

I understand that this is granted to Mr. Walpole on the grounds of his survey of the Western Desert of Egypt some years ago but, speaking as the Diplomatic Representative of the Kingdom of Jordan in London, I would very much like to stress the enormous value of what Mr. Walpole is doing in my country. His responsibility for the cadastral survey of Jordan, which provides a sound foundation on which the registration of titles in land can be based, may well rival in importance his achievements in Western Egypt.

On behalf of Mr. Walpole, I thank Your Royal Highness and the Society for this beautiful medal.

The PRESIDENT: In awarding the Victoria Medal to Professor Emmanuel de Martonne, your Council wish to recognize his long and distinguished contributions to the advancement of geography. Professor de Martonne has an international reputation, first for his work in physical and regional geography, and secondly as an Officer of the International Geographical Union. His 'Traité de géographie physique' in three volumes is recognized as a standard work; but he has not neglected the human aspects, as his very remarkable work on Central Europe in the 'Géographie universelle' testifies. He was Secretary-General of the International Geographical Union from 1931 to 1918, in which year he was elected President at the Congress at Amsterdam. As a tribute to his work in maintaining the continuity of the Union during the difficult years which followed, he was elected Honorary President for life at Lisbon last year. Few geographers can look back on so distinguished a share in the evolution of modern geography.

Monsieur le Roy, Counsellor at the French Embassy, and a former pupil of Professor de Martonne, will receive the medal on his behalf.

M JEAN LE ROY: Your Royal Highness, Mr. President, I do not attempt now to make a long speech but merely to ask you to allow me to read a few words which Monsieur de Martonne asked me to read to you.

C'est avec un vif regret que j'ai du renoncer à venir personnellement recevoir la médaille d'or Victoria que la Royal Geographical Society de Londres me fait le grand honneur de me décerner.

La réputation de cette Société est de celles qui sont faites dans tous les centres de culture scientifique. Fondée presque en même temps que la Société de géographie de Paris, elle a comme elle, jouée un rôle de premier plan dans l'essor de découvertes qui a marqué au XIXème siècle l'élargissement des horizons géographiques. Depuis le XXème siècle elle s'est associée au mouvement de reconnaissance approfondie des faits géographiques à la lumière du développement des sciences connexes.

C'est pour avoir contribué dans la mesure de mes moyens à ce mouvement que je puis avoir été jugé digne de la haute distinction qui m'est accordée et pour laquelle je vous suis profondément reconnaissant.

The PRESIDENT: Dr. E. C. Willatts, who receives the Gill Memorial, was associated for many years with Professor Dudley Stamp in the organization of the Land Utilization Survey of Britain, to which he also contributed a number of monographs. First as Maps Officer and then as Senior Research Officer of the Ministry of Town and Country Planning, he has continued to apply the geographical approach to contemporary problems, and has been responsible for the production of the 10-mile series of maps, which may one day form the basis of a National Atlas of Britain. In 1946, as an officer of the Anglo-American Commission to Palestine, he had opportunities of studying the geographical background to a complex situation.

Dr. E. C. WILLATTS: I would like to express my very great appreciation of the honour which the Society has done me. I find it difficult to believe that any work which I have carried out deserves this distinction. My appreciation is only matched by the surprise which I felt on first learning of the award. Perhaps it is a fact that I have just been fortunate in my opportunities as a geographer. In the Land Utilization Survey, Dr. Dudley Stamp, its Director who justly received the highest honour of the Society last year, gave me exceptional opportunities; and in the matter of Palestine it was for me the fortune of circumstances that the Government almost unprecedentedly decided to appoint a geographer to aid that Commission and that their choice fell on me.

Of my work I would like to say two things: first, that it was satisfying work in that it was intrinsically rewarding to be able to carry out investigations and to analyse the results within a prescribed field; also to prepare and present the results in a relatively simple pattern, so that they were available for all to study and at the service not only of fellow-geographers but of administrators and others. Secondly, much of the work was only possible as a result of the enthusiastic cooperation of many co-workers, and I feel a special sense of satisfaction that in this award many of those colleagues and friends of mine will see a real measure of appreciation of their work in geographical research.

The PRESIDENT: Surgeon Commander E. W. Bingham, R.N., to whom your Council have awarded the Murchison Grant, has had long experience of Arctic exploration since he accompanied Gino Watkins to Greenland in 1930. Later he was a member of the British Graham Land Expedition led by John Rymill, and carried out a number of important sledge journeys. He is, as a result, an authority on dogs and sledging in Polar conditions. This award marks particularly his work when he returned to that area as leader of the Falkland Islands Dependencies Survey from 1945 to 1947.

Surgeon Commander E. W. BINGHAM, R.N.: I am deeply grateful for the honour you have done me to-day. I sincerely feel that the award is intended to reflect also on the members of my expedition without whose loyal help and cooperation the work could not have been done.

The PRESIDENT: Mr. R. F. Peel, to whom your Council have awarded the Cuthbert Peek Grant, is Lecturer in Geography in the University of Cambridge. Before the war he was a member of Brigadier Bagnold's expedition to the Libyan desert, and during the war as a surveyor he extended his knowledge of that region. He has published a number of papers, not only on its physical geography, but also on the desert peoples, and is now working on the morphology of the rivers of Northern England.

Mr. R. F. PEEL: I wish to express the very deep appreciation I feel for this award which the Royal Geographical Society has seen fit to make. Like the previous speaker, I feel I have done little to deserve it. Such work as I have been able to accomplish was the result of the circumstances in which I found myself. In particular, Brigadier Bagnold, a member of the Council of this Society, gave me every encouragement and help in carrying out the work in the Libyan Desert. In future, perhaps, I shall be able to extend that work and so repay some of the debt of gratitude I feel I owe to the Society.

The PRESIDENT: The Back Grant has been awarded to Mr. R. G. Goodchild, Deputy Director of the British School at Rome. Between 1946 and 1949, he led archaeological expeditions to Tripolitania to study the historical geography of the Roman frontiers in North Africa, and the social and economic organization of the frontier provinces. The results of this work he described to us recently at an Evening Meeting. He is leading another expedition this summer, and we look forward to the results with great interest.

Dr. Mortimer Wheeler, Secretary of the British Academy, will receive the grant on behalf of Mr. Goodchild.

Dr. MORTIMER WHEELER: I have the great, if vicarious, honour of receiving this award on behalf of my absent friend, Mr. Goodchild. Mr. Goodchild's explorations in Libya have renewed and strengthened the traditional link between the Royal Geographical Society and archaeology. In the past the most notable name in this context has been that of the late Sir Aurel Stein who was as much a geographer as an archaeologist and who made outstanding contributions to our knowledge in both capacities. More recently Mr. O. G. S. Crawford has united the two. Now we have Mr. Goodchild whose work in Cyrenaica and Tripolitania has shown that there were "desert rats" in those parts before the 8th Army appeared on the scene, and that the Ancient Romans progressed farther than the modern Italians in the development of that difficult country.

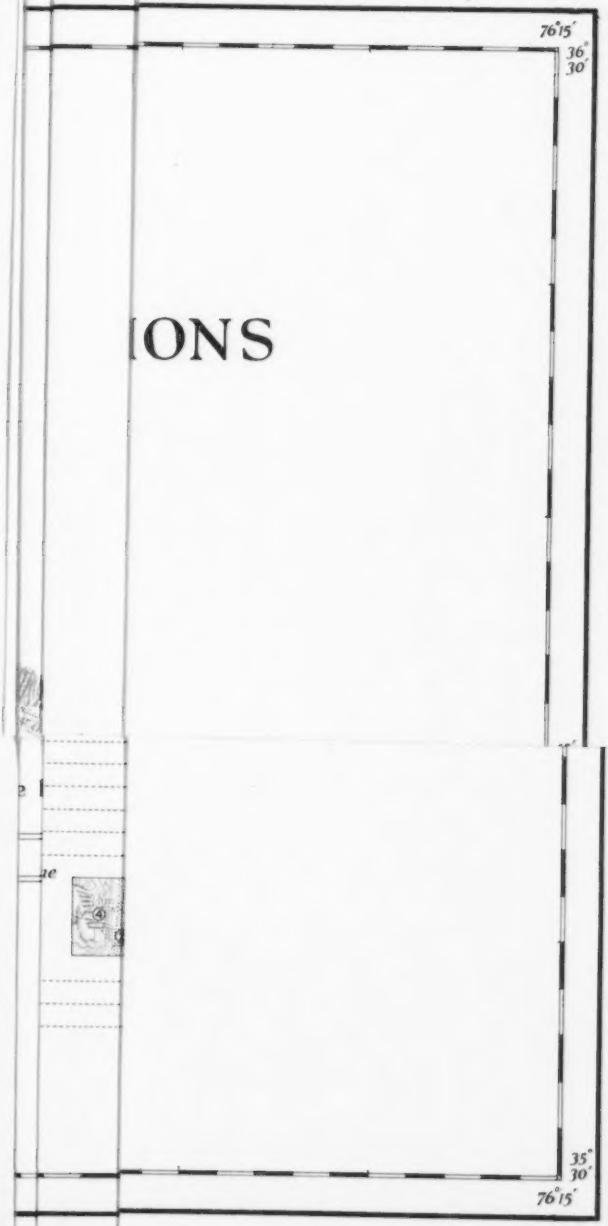
The present award for explorations, carried out not without difficulty but with success, is at the same time a reward and stimulus and on behalf of Mr. Goodchild I receive it as an earnest of future endeavour no less than as a symbol of work accomplished in the past. Your Royal Highness and Mr. President, on behalf of the real recipient of the award I thank you for this very signal honour.

The PRESIDENT then appointed Miss Wanklyn and Mr. G. W. Murray to act as scrutineers of the ballot for the Council and Officers for the ensuing year. While the ballot was in progress the President drew attention to the main items of the Annual Report which had been circulated to Fellows, and inquired whether there were any questions or comments that Fellows wished to raise.

There being no questions, the Annual Report was unanimously adopted.

The scrutineers informed the President that by the unanimous vote of 121 Fellows the list of candidates proposed as Council and Officers for the ensuing year had been elected.

There being no other business, the PRESIDENT thanked Fellows and their guests for their attendance and the proceedings terminated.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Ghamsta C.G.
Charesa 17,532
Minapin
Zangia Harar Hoyi
Miram Chucham
Shakoshai
Hakhisho
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Mongbil Sar 24,090
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Chipurgham C.G. 16,830
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Jawari
Bitanmal C.G.
Menchhish Chukutans
Turajah
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Dachigam
Chande Chhish 19,995
Khinyang Chhish 19,762
Pumarikish 24,580
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Mokrong Lha 21,490
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Limits of map sheets containing surveys by P.G. Mott and M.A. Spender

GREATER CHHIL MOUNTAINS
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HIMALAYA
Shimshal
Nagar
Gilgit
Arandu
Askole
Rondu
Astor
Nanga Parbat 26,660
Skardu
Bandipura
Kargil
SRINAGAR
LEH
Indus
Shyok
Kashmir

RELIABILITY DIAGRAM

A Deliberate plane-table Surveys by Fazal Ellahi and Inayat Khan of the Survey of India, based on a triangulation by P.G. Mott.

B Plotted from Photo-Theodolite Survey by E.E. Shipton.

C Rapid plane-table Surveys by P.G. Mott.

Scale 1:253,440 or 4 miles to One Inch

2 1 0 2 4 6 8 10 12 Miles

5 0 5 10 15 20 Kilometres

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Snow and

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E.W. Yeates, del.

Published by the Royal Geograph

HISPAR - BIAFO GLACIAL REGIONS
(KARAKORAM HIMALAYA)

Surveyed by Members of E.E. Shipton's
Karakoram Expedition 1939

LEGEND

- Rock Tracks
- Routes followed by expedition
- Grazing Ground: Camping Ground ..... G. C. C. C.
- Traveller's Bungalow ..... T. B
- Huts: permanent: temporary
- Contours: Rocky slopes
- Snow and Ice forms ..... 1 glacier 2 moraine 3 crevasses 4 scree 5 perpetual snow

- Triangulation Stations ..... △ 19,560
- Points fixed by theodolite ..... ⊙ 25,761
- Other intersected points ..... · 19,570

THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE, LONDON, S.W.7

FELLOWSHIP AND ASSOCIATE MEMBERSHIP

The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

It is provided by Chapter III, § 1, of the Bye-Laws that a candidate for admission to the Fellowship of the Society must be proposed and seconded by Fellows. Further, that a candidate is not to be considered eligible until he has attained the age of twenty-one years, unless he holds a Commission in His Majesty's Forces or is a matriculated student of a University of the United Kingdom or the Self-Governing British Dominions. Proposal forms can be obtained on application to the Director and Secretary, who will also lend if necessary a List of Fellows.

Chapter V, § 1, of the Bye-Laws provides that—

(a) Every Fellow (other than those elected under Chapter III, § 6) shall, except as provided below, be required to pay either on Election Five pounds as Entrance Fee and Three pounds as Annual Subscription for the current year and thereafter an Annual Subscription of Three pounds due on January 1 in each year; or instead of an Entrance Fee on election an enhanced Annual Subscription of Four pounds for the current and five following years, and thereafter Three pounds; or a single Compounding Fee of Sixty pounds.

For Fellows who are under the age of 25 years on election the Entrance Fee shall be reduced from Five pounds to Two pounds; or alternatively the enhanced Annual Subscription of Four pounds shall be payable for the current year and for two following years instead of for five.

Fellows who are on election the wives or husbands of Fellows shall pay no Entrance Fee.

Fellows who are on election the widows or widowers of Fellows shall pay no Entrance Fee if elected within one year of the decease of husband or wife.

(b) Fellows may compound for their Annual Subscriptions at any subsequent time by a payment of £60 (sixty pounds) less £2 (two pounds) for each Annual Subscription paid in excess of five with a minimum of £10 (twenty pounds) after 25 payments.

(c) No Fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear.

Chapter IIIa of the Bye-Laws, covering the terms of Associate Membership, provides that—

1. *Candidates must be not less than 17 and not more than 20 years of age. They must be recommended by a Fellow, University or School authority.*
2. *Subscription shall be £2 per annum without Entrance Fee.*
3. *On attaining the age of 21 Associate Members become eligible for Fellowship. The Entrance Fee of £5 shall be waived provided they have been Associate Members for 3 years. Otherwise Associate Membership shall cease at the age of 21.*

All subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow or Associate Member include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Society's House, Library, and Map-room. Each Fellow is also entitled to receive a copy of all the Society's Periodical Publications. Associate Members have the choice of receiving either *The Geographical Journal* or *The Geographical Magazine*. Associate Members may not describe themselves as F.R.G.S. and have no vote at Annual or Special General Meetings.

A pamphlet giving a brief History of the Society, with a description of its Work and Publications, its Charter and Bye-Laws, and an illustrated account of its House in Kensington Gore, can be sent to anyone interested on application to the Director and Secretary.

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